HANDBOOK

OF

GEOLOGICAL TERMS

AND

GEOLOGY

BY

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TO

JAMES POWRIE, F.G.S.

IN REMEMBRANCE OF PLEASANT WANDERINGS

IN THE INVESTIGATION OF THE OLDER ROCK-FORMATIONS

OF OUR NATIVE COUNTRY.

PREFACE.

Should it be asked why I publish this volume, I answer, along with many others, Because I believe such a Handbook to be greatly needed; and under this conviction have done my best, within moderate limits, to render it useful. Go where you will—to the popular platform, the public lecture-room, or the private parlour—and you hear immense interest professed in the science of Geology; but the profession, for the most part, accompanied by the regret that its "hard words and forbidding technicalities" should render it so difficult of acquirement. Now, while deprecating, in the strongest manner, the introduction of unnecessary terms, it is quite evident that every science must have its own technicalities and modes of expression: new objects require new names, and new facts new phrases to express their relations. There is no avoiding this necessity in any progressive branch of human knowledge, and the only thing that can be done to lessen the difficulty—next to the rigid exclusion of whatever seems superfluous—is to explain these terms in brief and simple language. This I have endeavoured to do, chiefly with a view to the requirements of the general

reader, at the same time appending such details as might render the volume an acceptable Handbook of Reference to the student and professed Geologist. Thus the ordinary reader will generally find the information he requires in the first and second sentences of a definition ; what follows is addressed more especially to the professional inquirer—to the student, miner, engineer, architect, agriculturist, and others, who may have occasion to deal with geological facts, and yet who might not be inclined to turn up half-a-dozen volumes, or go through a course of geological readings, for an explanation of the term in question.

Such is the aim and object of this "Handbook of Geological Terms." I lay claim to little more than the arrangement of the matter which has been gleaned and sifted from many sources—care having always been taken to present the science in its newest aspects, and to express its facts in the clearest and simplest language. Sensible of many imperfections, I would respectfully solicit corrections from those who may generally approve of the work, in order that any subsequent edition may be rendered more worthy of the Science whose truths we are labouring to establish—a science which, whether intellectually or economically considered, stands second to none on the roll of human acquirements.

D. P.

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NOTE.—"It is, indeed," says Agassiz, in his recent *Essay on Classification*, "a very unfortunate tendency, which prevails now almost universally among naturalists, with reference to all kinds of groups, of whatever value they may be, from the branches down to the species, to separate at once from one another any types which exhibit marked differences, without even inquiring first whether these differences are of a kind that justifies such separations. In our systems, the quantitative element of differentiation prevails too exclusively over the qualitative. If such distinctions are introduced under well-sounding names, they are almost certain to be adopted; as if science gained anything by concealing a difficulty under a Greek or Latin name, or was advanced by the additional burden of a new nomenclature. Another objectionable practice, prevailing quite as extensively also, consists in the change of names, or the modification of the extent and meaning of old ones, without the addition of new information or of new views. If this practice is not abandoned, it will necessarily end in making Natural History a mere matter of nomenclature, instead of fostering its higher philosophical character." Influenced by this opinion, I have adopted in the following tabulations such arrangements of the Mineral, Vegetable, and Animal kingdoms as have been sanctioned by our leading naturalists—which appear to be most intelligible to the general reader—and on which, indeed, the greater portion of the nomenclature of Geology and Palæontology has been founded.

CHEMICAL SCHEME,

Exhibiting the so-called "Elementary Substances" in alphabetical order, with their symbols and chemical equivalents—hydrogen being taken as 1.

Elements.	*Symbols.*	*Equivalents.*
Aluminium	Al	13.69
Antimony (*Stibium*)	Sb	129.03
Arsenic	As	75.
Barium	Ba	68.64
Bismuth	Bi	70.95
Boron	B	10.90
Bromine	Br	78.26
Cadmium	Cd	55.74
Calcium	Ca	20.
Carbon	C	6.
Cerium	Ce	46.
Chlorine	Cl	35.50
Chromium	Cr	28.15
Cobalt	Co	29.52
Copper (*Cuprum*)	Cu	31.66
Didymium	—	—
Erbium	—	—
Fluorine	F	18.70
Glucinium or Beryllium	Gl	26.50
Gold (*Aurum*)	Au	98.33
Hydrogen	H	1.
Ilmenium	Il	—
Iodine	I	126.36
Iridium	Ir	98.68
Iron (*Ferrum*)	Fe	28.
Lanthanum	Ln	48.
Lead (*Plumbum*)	Pb	103.56
Lithium	Li	6.43
Magnesium	Mg	12.67
Manganese	Mn	27.67
Mercury (*Hydrargyrum*)	Hg	100.07
Molybdenum	Mo	47.88
Nickel	Ni	29.57
Niobium	Nb	—
Nitrogen	Ni	14.
Norium	No	—

Elements.	*Symbols.*	*Equivalents.*
Osmium	Os	95.56
Oxygen	O	8.
Palladium	Pd	53.27
Pelopium	Pe	—
Phosphorus	P	32.
Platinum	Pt	98.68
Potassium (*Kalium*)	K	39.
Rhodium	R	52.11
Ruthenium	Ru	52.11
Selenium	Se	39.57
Silicium, Silicon	Si	21.35
Silver (*Argentum*)	Ag	108.
Sodium (*Natrium*)	Na	22.97
Strontium	Sr	43.84
Sulphur	S	16.
Tantalum or Columbium	Ta	92.30
Tellurium	Te	66.14
Terbium	—	—
Thorium	Th	59.59
Tin (*Stannum*)	Sn	58.82
Titanium	Ti	24.29
Tungsten or Wolfram	W	94.64
Uranium	U	60.
Vanadium	V	68.55
Yttrium	Y	32.20
Zinc	Zn	32.52
Zirconium	Zr	33.62

Of the preceding elementary or ultimate substances only a few enter largely into the composition of the earth's crust; and of the others many are extremely rare, or only evolved from their natural unions by chemical analysis. In the following list the most important (geologically speaking) are printed in capitals, their characters being given as under the ordinary pressure and temperature of the atmosphere:—

Gases—HYDROGEN, OXYGEN, nitrogen, CHLORINE, and FLUORINE.

Non-Metallic Liquids and Solids—Bromine, iodine, SULPHUR, PHOSPHORUS, selenium, CARBON, boron, SILICON.

Metals being the bases of the Earths and Alkalies—POTASSIUM, SODIUM, lithium; barium, strontium, CALCIUM; MAGNESIUM, ALUMINIUM, thorium, glucinium, zirconium, yttrium.

The Metals—MANGANESE, ZINC, IRON, TIN, cadmium, COBALT, NICKEL; ARSENIC, CHROMIUM, vanadium, molybdenum, tungsten, columbium, ANTIMONY, uranium, cerium, BISMUTH, titanium, tellurium, COPPER, LEAD; MERCURY, SILVER, GOLD, PLATINUM, palladium, rhodium, osmium, iridium, ruthenium; (and the following, of which little is yet determined), erbium, terbium, didymium, lanthanum, niobium, norium, ilmenium, pelopium.

MINERAL SCHEME,

Exhibiting the simple minerals, or constituents of rock-masses, as arranged by Professor Weiss, of Berlin, into Orders and Families.

I. ORDER—OXIDISED STONES.

Families:—
1. Quartz.
2. Felspar.
3. Scapolite.
4. Haloid Stones.
5. Leucite.
6. Zeolites.
7. Mica.
8. Hornblende.
9. Clays.
10. Garnet.
11. Gems.
12. Metallic Stones.

II. ORDER—SALINE STONES.

Families:—
1. Calc-spar.
2. Fluor-spar.
3. Heavy-spar.
4. Gypsum.
5. Rock-salt.

III. ORDER—SALINE ORES.

Families:—
1. Sparry Iron Ores.
2. Copper Salts.
3. Lead Salts.

IV. ORDER—OXIDISED ORES.

Families:—
1. Iron Ores.
2. Tinstone.
3. Manganese Ores.
4. Red Copper Ores.
5. White Antimony Ores.

V. ORDER—NATIVE METALS.

Form only one Family.

VI. ORDER—SULPHURETTED METALS.

Families:—
1. Iron Pyrites.
2. Galena.
3. Grey Antimony Ore.
4. Grey Copper Ore.
5. Blende.
6. Ruby Blende.

VII. ORDER—INFLAMMABLES.

Families:—
1. Sulphur.
2. Diamond.
3. Coal.
4. Mineral Resins.
5. Combustible Salts.

MINERAL SCHEME.

The following list contains the so-called Species usually arranged under the respective families—the more abundant and better known being marked in Italics :—

ORDER—OXIDISED STONES.

1. Quartz Family (2 Species).—*Quartz*, *Opal.*

2. Felspar Family (14 Species).—*Orthoclase*, Ryacolite, *Albite*, Andesin, Saccharite, *Labradorite*, Couzeranite, Anorthite, *Oligoclase*, Petalite, Spodumene, Kastor, Pollux, *Amorphous Felspar*.

3. Scapolite Family (13 Species).—*Scapolite*, Nuttalite, Barsowite, Ottrelite, *Palagonite*, Dipyr, Nepheline, Davyne, Gehlenite, Humboldtilite, *Prehnite*, Zeuxite, *Nephrite.*

4. Haloid Stones (9 Species).—*Lazulite*, Calaite, *Wavellite*, Wagnerite, Amblygonite, Alunite, Aluminite, Pissophane, Latrobite.

5. Leucite (8 Species).—*Leucite*, Porcelain spar, Sodalite, Hauyne, Nosean, Ittnerite, *Lapis Lazuli*, Eudialite.

6. Zeolites (22 Species). — *Analcime*, *Natrolite*, *Scolezite*, Damourite, Thomsonite, *Stilbite*, Aedelforsite, *Heulandite*, Brewsterite, *Epistilbite*, *Apophyllite*, Okenite, Pectolite, *Chabasite*, Faujasite, *Harmotome*, Phillipsite, Zeagonite, Laumonite, Leonhardite, Glottalite, Edingtonite.

7. Mica Family (31 Species).—*Potash Mica*, Lithia Mica, *Magnesia Mica*, Lepidomelane, Chloritoid, *Chlorite*, Ripidolite, *Talc*, *Schillerspar*, Antigorite, Hydropite, *Serpentine*, Picrosmine, Villarsite, Spadaite, Gymnite, Chonikrite, Pyrosklerite, Kämmererite, Pyrosmalite, Cronstedtite, Stilpnomelan, Brucite, *Hydromagnesite*, Nemalite, Seybertite, Margarite, Pyrophyllite, Anauxite, Pholerite, Rosellan.

8. Hornblende Family (19 Species).—*Hornblende*, *Augite*, *Hypersthene*, *Bronzite*, *Diallage*, *Rhodonite*, Tephroite, Troostite, Wollastonite, Achmite, Sordawalite, Krokydolite, Pyrallolite, Pyrargillite, Karpholite, Babbingtonite, *Isopyre*, Polylite, Tachylite.

9. Clays (24 Species).—*Kaolin*, *Clay*, Rock-soap, Plinthite, *Green-Earth*, Yellow - Earth, Halloysite, *Fullers'-Earth*, Allophane, Schrötterite, Challilite, *Bole*, Teratolite, Kollyrite, *Lithomarge*, Miloschin, Kerolite, *Agalmatolite*, *Soapstone*, *Pipestone*, *Meerschaum*, Pimelite, Dermatin, Retinalite.

10. Garnet Family (15 Species).—*Garnet*, *Pyrope*, Helvine, *Idocrase*, *Epidote*, Axinite, *Cyanite*, Sillimanite, Bamlite, *Andalusite*, *Staurolite*, Diaspore, Hydrargillite, Periclase, Glaucophane.

11. Gems (16 Species).—*Zircon*, Malacon, *Spinel*, Automalite, *Corundum*, *Crysoberyl*, *Topaz*, Pycnite, Leucophane, *Euclase*, *Emerald*, Phenakite, *Iolite*, *Tourmaline*, *Crysolite*, Chondrodite.

12. Metallic Stones (22 Species).—*Liëvrite*, Hisingerite, *Anthosiderite*, Nontronite, Pinguite, Chloropal, *Chlorophæite*, *Thorite*, Eulytine, Gadolinite, *Allanite*, Tschewkinite, *Cerite*, Pyrochlore, Keilhauite, Polymignite, Polycrase, Perorskite, Aeschynite, Mengite, Monazite, Samarskite.

ORDER—SALINE STONES.

1. CALC-SPAR FAMILY (6 Species).—*Calc-spar, Dolomite,* Breunnerite, *Magnesite,* Mesitine Spar, *Arragonite.*
2. FLUOR-SPAR FAMILY (14 Species).—*Fluor-spar,* Yttrocerite, *Fluocerite,* Fluocerine, *Cryolite,* Chyolite, Hopeite, *Apatite,* Herderite, Childrenite, Xenotime, *Boracite, Hydroboracite, Datholite.*
3. HEAVY-SPAR FAMILY (7 Species).—*Barytes,* Dreelite, *Witherite, Alstonite, Baryto-Calcite, Celestine, Strontianite.*
4. GYPSUM FAMILY (7 Species).—*Gypsum, Anhydrite,* Polyhalite, *Glauberite,* Pharmacolite, Haidingerite, *Berzelite.*
5. ROCK-SALT FAMILY (28 Species).—*Rock-Salt, Alum, Alunogene, Glauber Salt, Melanterite,* Botryogene, Copiapite, Coquimbite, Tectizite, Cyanose, Goslarite, Bieberite, Johannite, *Natron, Thermonatrite, Trona,* Gaylussite, *Borax, Sassoline, Nitre, Nitratine, Nitrocalcite,* Nitro-Magnesite, *Sal-Ammoniac,* Mascagnine, Arcanite, Thenardite, *Epsomite.*

ORDER—SALINE ORES.

1. SPARRY IRON ORES (17 Species).—*Siderite,* Ankerite, *Diallogite,* Manganocalcite, Lanthanite, Parisite, *Calamine, Galmei,* Williamite, Triplite, Zwièselite, Triphyline, Hureaulite, Heterozite, Alluaudite, Pitticite, Diadochite.
2. COPPER SALTS (30 Species).—*Dioptase, Chrysocolla, Azurite, Malachite,* Aurichalcite, *Chalcophyllite,* Tirolite, Erinite, Liroconite, Olivenite, Euchroite, Klinoclase, *Phosphorochalcite,* Thrombolite, Libethenite, Tagilite, Ehlite, *Atacamite,* Volborthite, *Arseniosiderite,* Pharmakosiderite, Scorodite, Symplesite, Brochantite, *Vivianite,* Dufrenite, *Uranite, Chalcolite,* Erythrine, *Nickeline.*
3. LEAD SALTS (27 Species).—*Cerussite, Anglesite, Leadhillite, Lanarkite,* Caledonite, Linarite, *Phosgenite,* Mendipite, Cotunnite, *Pyromorphite,* Mimetesite, Bleinierite, Vanadinite, *Wulfenite,* Scheelitine, Plombgomme, *Crocoisite,* Melanochroite, *Vauquelinite,* Bismuthite, *Kerate, Calomel,* Iodite, Coccinite, Bromite, Romeïte, *Scheelite.*

ORDER—OXIDISED ORES.

1. OXIDISED IRON ORES (9 Species).—*Magnetite, Chromite,* Franklinite, *Hœmatite, Irite, Limonite, Gotheite, Ilmenite,* Iserine.
2. TIN ORE FAMILY (13 Species).—*Cassiterite, Wolfram, Columbite, Tantalite, Yttrotantalite,* Euxinite, Fergusonite, *Sphene, Brookite, Rutite, Anatase, Pechurane, Plattnerite.*
3. MANGANESE ORES (20 Species).—*Pyrolusite,* Polianite, *Manganite,* Hausmannite, Braunite, *Psilomelane,* Crednerite, *Cupreous Manganese, Earthy Cobalt, Wad;*——(Ochres), Cobalt O., Molybdena O., Bismuth O., Antimony O., Tungsten O., Uranium O., Minium, Lead O., Chrome O., Tellurite.
4. RED COPPER ORES (4 Species).—*Cuprite, Chalcotrichite,* Tenorite, *Zincite.*
5. WHITE ANTIMONY ORES (2 Species).—Valentinite, *Arsenite.*

ORDER—NATIVE METALS.

1. The Metals (18 Species).—*Platinum, Palladium,* Osmiumiridium, Iridium, *Gold, Silver,* Antimony-Silver, *Mercury, Amalgam, Antimony,* Arsenic-Antimony, *Arsenic,* Tellurium, *Lead, Tin,* Bismuth, *Copper, Iron.*

ORDER—SULPHURETTED METALS.

1. Pyrites Family (21 Species).—*Pyrite, Marcasite,* Pyrrhotine, Leucopyrite, *Mispickel, Cobaltine, Smaltine,* Modumite, Linneïte, Grünauite, *Gersdorffite,* Ullmannite, Breithauptite, Plakodine, *Nickeline,* Rammelsbergite, Millerite, *Chalcopyrite,* Bornite, Domeykite, *Arseniate of Manganese.*
2. Lead Glance Family (17 Species).—*Galena, Cuproplumbite,* Clausthalite, Selencopper Lead, Onofrite, Naumannite, *Argentite,* Stromeyerite, *Redruthite,* Kupferindig, Eukairite, Berzeline, *Nagyagite,* Altaite, Hessite, Tetradymite, *Molybdenite.*
3. Grey Antimony Ores (16 Species).—*Stibine, Jamesonite, Zinckenite,* Plagionite, Boulangerite, Geokronite, Steinmannite, Plumosite, Dufréynoysite, Wolfsbergite, *Kermes,* Berthierite, *Bismuthine, Aciculite,* Kobellite, Sylvanite.
4. Grey Copper Ores (11 Species).—*Fahlore,* Tennantite, *Bournonite,* Wölchite, Freieslebenite, *Stephanite, Polybasite,* Sternbergite, *Stannine, Cupreous Bismuth, Bismuthic Silver.*
5. Blendes (5 Species).—*Blende,* Woltzine, *Alabandine,* Hauerite, *Greenockite.*
6. Ruby Blendes (6 Species).—*Pyrargyrite,* Miargyrite, Xanthokon, *Cinnabar, Realgar, Orpiment.*

ORDER—THE INFLAMMABLES.

1. Sulphur Family.—*Sulphur, Selen-Sulphur.*
2. Diamond.—*Diamond.*
3. Coals (5 Species).—*Graphite, Anthracite, Common Coal, Lignite, Peat.*
4. Mineral Resins (20 Species).—*Bitumen, Elaterite, Asphaltum,* Piauzite, Ixolyte, *Amber, Retinite,* Walchowite, *Copaline,* Berengelite, *Guyaquillite,* Hartine, *Middletonite, Ozokerite, Hatchetine,* Fichtelite, Hartite, Könlite, Scheererite, Idrialite.
5. Inflammable Salts (2 Species).—Mellite, Oxalate.

VEGETABLE SCHEME.

The Vegetable Kingdom may be arranged into two grand divisions—the CELLULAR and VASCULAR, and these, according to their modes of growth and reproduction, into the following groups and classes:—

I. CELLULAR—Without regular vessels, but composed of fibres which sometimes cross and interlace each other. The *Confervæ* (green scum-like aquatic growths), the *Lichens* (which incrust stones and decaying trees), the *Fungi* (or mushroom tribe), and the *Algæ* (or sea-weeds), belong to this division. In some of these families there are no apparent seed-organs. From their mode of growth, viz. sprout-like increase of the same organ, they are known as THALLOGENS or AMPHIGENS.

II. VASCULAR—With vessels which form organs of nutrition and reproduction. According to the arrangement of these organs, vascular plants have been grouped into two great divisions—CRYPTOGAMIC (no visible seed-organs), and PHANEROGAMIC (apparent flowers or seed-organs). These have been further subdivided into the following classes:—

1. CRYPTOGAMS—Without perfect flowers, and with no visible seed-organs. To this class belong the *mosses*, *equisetums*, *ferns*, and *lycopodiums*. It embraces many fossil forms allied to these families. From their mode of growth, viz. increase at the top or growing point only, they are known as ACROGENS.
2. PHANEROGAMIC MONOCOTYLEDONS—Flowering plants with one cotyledon or seed-lobe. This class comprises the *water-lilies*, *lilies*, *aloes*, *rushes*, *grasses*, *canes*, and *palms*. In allusion to their growth, by increase within, they are termed ENDOGENS.
3. PHANEROGAMIC GYMNOSPERMS—This class, as the name indicates, is furnished with flowers, but has naked seeds. It embraces the *cycadeæ* or pine-apple tribe, and the *coniferæ* or firs. In allusion to their naked seeds these plants are also known as GYMNOGENS.
4. PHANEROGAMIC DICOTYLEDONS—Flowering plants with two cotyledons or seed-lobes. This class embraces all forest trees and shrubs—the *compositæ*, *leguminosæ*, *umbelliferæ*, *cruciferæ*, and other similar orders. None of the other families of plants have the true woody structure, except the *coniferæ* or firs, which seem to hold an intermediate place between monocotyledons and dicotyledons; but the wood of these is readily distinguished from true dicotyledonous wood. From their mode of growth, increase by external rings or layers, they are termed EXOGENS.

Or, founding, *first*, on the different modes of reproduction; *second*, on the aspect of the reproducing organs; *thirdly*, on the primary development; and *fourthly*, on the ultimate development of the plant, the botanist arrives at a scheme of classification which may be tabulated as follows:—

SPERMOCARPS	ANGIOSPERMS	EXOGENS	DICOTYLEDONS	Trees, Shrubs, Herbs.
		ENDOGENS	MONOCOTYLEDONS	Grasses, Sedges, Palms.
	GYMNOSPERMS	GYMNOGENS	POLYCOTYLEDONS	Cycads and Conifers.
SPOROCARPS	ANGIOSPORES	ACROGENS	SPOROGAMS	Clubmosses, Lycopods.
			THALLOGAMS	Ferns and Horsetails.
			AXOGAMS	Mosses and Liverworts.
	GYMNOSPORES	AMPHIGENS	HYDROPHYTES	Algæ and Confervæ.
			AËROPHYTES	Lichens.
			HYSTEROPHYTES	Fungi or Mushrooms.

Subdividing still further, according to their most marked characteristics, whether external or internal, the Botanist arranges all the forms of Vegetable Life into some 60 or 70 *orders*, about 305 *genera*, and nearly 100,000 *species*. As most of these distinctions, however, are founded on the form and connection of the flower, fruit, and leaf—organs which rarely or ever occur in connection in a fossil state—the Palæontologist is guided in the main by the great structural distinctions above adverted to, and not unfrequently by the simple but unsatisfactory test of "general resemblance."

Or, following the arrangement adopted by Professor Lindley, we have the subjoined classes, sections, and alliances :—

Class I. THALLOGENS—Asexual or Flowerless plants, without proper stems or leaves. These include three alliances—*Algales*, *Fungales*, and *Lichenales*.

Class II. ACROGENS—Asexual or Flowerless plants with stems and leaves. Includes three alliances—*Muscales*, *Lycopodales*, and *Filicales*.

Class III. RHIZOGENS—Sexual or Flowering plants with Acotyledonous embryos and fructification, springing from a thallus—as in *Rafflesiaceæ*.

Class IV. ENDOGENS—Monocotyledonous Flowering plants with Endogenous stems, parallel venation, and ternary symmetry. This class is subdivided into four sections :—

1. Plants with glumaceous flowers formed by imbricated bracts.
2. Petaloid unisexual flowers.
3. Petaloid hermaphrodite flowers adherent to the ovary.
4. Petaloid hermaphrodite flowers free from the ovary.

Under these sections are included 11 alliances, such as *Glumales*, *Arales*, *Palmales*, *Narcissales*, *Orchidales*, *Juncales*, and *Liliales*.

Class V. DICTYOGENS—Monocotyledonous plants with reticulated venation, including such orders as *Discoreaceæ*, *Smilaceæ*, and *Trilliaceæ*.

Class VI. GYMNOGENS—Polycotyledonous Exogens with naked seeds, as *Coniferæ* and *Cycadaceæ*.

Class VII. EXOGENS—Dicotyledonous plants with seeds in a seed-vessel. Under this head are arranged the following sub-classes :—

Sub-class 1. DICLINOUS EXOGENS, or Dicotyledons with unisexual flowers, and no tendency to form hermaphrodite flowers; includes 8 alliances, such as *Amentales*, *Urticales*, *Euphorbiales*, *Menispermales*, *Cucurbitales*.

Sub-class 2. HYPOGYNOUS EXOGENS, or Dicotyledons with hermaphrodite or polygamous flowers, and stamens entirely free from the calyx and corolla; including 14 alliances, such as *Violales*, *Cistales*, *Malvales*, *Nymphæales*, *Ranales*, *Berberales*, *Ericales*, *Rutales*, *Geraniales*, *Silenales*, *Chenopodales*, and *Piperales*.

Sub-class 3. PERIGYNOUS EXOGENS, or Dicotyledons with hermaphrodite or polygamous flowers, the stamens growing to the side of either the calyx or corolla, ovary superior, or nearly so; includes 10 alliances, such as *Daphnales*, *Rosales*, *Saxifragales*, *Gentianales*, *Solanales*, *Echiales*, and *Bignoniales*.

Sub-class 4. EPIGYNOUS EXOGENS, or Dicotyledons with hermaphrodite or polygamous flowers, the stamens growing to the side of either the calyx or corolla, ovary inferior or nearly so. This includes 7 alliances—*Campanales*, *Myrtales*, *Cactales*, *Grossales*, *Cinchonales*, *Umbellales*, and *Asarales*.

COMPARATIVE ARRANGEMENTS.

The following tabulation exhibits, comparatively, the systematic schemes of Brongniart, Göppert, Bronn, and Lindley—names the most intimately associated with the exposition and advancement of Palæophytology, or the science of Fossil Botany:—

		BRONGNIART.	GÖPPERT; BRONN.	UNGER.	LINDLEY.
CRYPTOGAMÆ		Amphigenæ	Pl. Cellulares, Aphyllæ	Thallophyta	Thallogens.
		Funginæ. Algæ.			
		Acrogenæ	Pl. Vasculares, Cryptogamæ	Acrobrya	Acrogens. Rhizogens.
		Filicinæ. Characeæ. Lycopodiaceæ. Equisetaceæ.			
PHANEROGAMÆ		Monocotyledones	Phanerogamæ	Amphibrya	Endogens.
		Cyperaceæ. Typhaceæ. Pandaneæ. Palmæ.			
	Dicotyledones.	Gymnospermæ	Gymnospermæ	Gymnosperma	Gymnogens.
		Calamiteæ. Asterophyllitæ. Sigillariæ. Cycadeæ. Nœggerathiæ. Coniferæ.			
		1. Apetalæ	Angiospermæ. Monochlamideæ	Acramphibrya. Apetalæ	Exogens.
		2. Gamopetalæ	Angiospermæ. Corolliforæ	Acramphibrya. Gamopetalæ	Exogens.
		3. Dialypetalæ	Angiospermæ. Choristopetalæ	Acramphibrya. Dialypetalæ	Exogens.
		(1.) *Betulinæ. Ceratophylleæ. Proteaceæ.* (2.) *Styracifiueæ.* (3.) *Halorageæ. Cucurbitaceæ. Leguminosæ. Sapindaceæ. Malvaceæ. Rhamneæ.*			

ANIMAL SCHEME.

The following arrangement—being chiefly that of Cuvier, with such modifications as the progress of science demands—will render sufficiently apparent the main subdivisions and relations of the animal kingdom, and enable the reader to determine more readily the position of any fossil form in the scheme of vitality :—

VERTEBRATA,

Or animals with back-bone and bony skeleton, and comprehending

MAMMALIA; AVES; REPTILIA; and PISCES.

I. MAMMALIA or *Sucklers*, sub-divided into Placental and Aplacental.

1. PLACENTAL, bringing forth mature young.

BIMANA (*Two-handed*)—Man.
QUADRUMANA (*Four-handed*)—Monkeys, Apes, Lemurs.
CHEIROPTERA (*Hand-winged*)—Bats, Vampyre-bats, Fox-bats.
INSECTIVORA (*Insect-eaters*)—Mole, Shrew, Hedgehog, Banxring.
CARNIVORA (*Flesh-eaters*)—Dog, Wolf, Tiger, Lion, Badger, Bear.
PINNIPEDIA (*Fin-footed*)—Seals, Walrus.
RODENTIA (*Gnawers*)—Hare, Beaver, Rat, Squirrel, Porcupine.
EDENTATA (*Toothless*)—Ant-eater, Armadillo, Pangolin, Sloth.
RUMINANTIA (*Cud-chewers*)—Camel, Llama, Deer, Goat, Sheep, Ox.
SOLIDUNGULA (*Solid-hoofs*)—Horse, Ass, Zebra, Quagga.
PACHYDERMATA (*Thick-skins*)—Elephant, Hippopotamus, Rhinoceros, Pig.
CETACEA (*Whales*)—Whale, Porpoise, Dolphin, Lamantin.

2. APLACENTAL, bringing forth immature young.

MARSUPIALIA (*Pouched*)—Kangaroo, Opossum, Pouched Wolf, &c.
MONOTREMATA (*One-vented*)—Ornithorhynchus, Porcupine-ant-eaters.

II. AVES or BIRDS.

RAPTORES (*Seizers*)—Eagles, Falcons, Hawks, Owls, Vultures.
INSESSORES (*Perchers*)—Jays, Crows, Finches, Sparrows, Thrushes, &c.
SCANSORES (*Climbers*)—Woodpeckers, Parrots, Cockatoos, &c.
COLUMBÆ (*Pigeons*)—Common Dove, Turtle Dove, Ground Dove.

RASORES (*Scrapers*)—Barnfowl, Partridge, Grouse, Pheasant.
CURSORES (*Runners*)—Ostrich, Emeu, Apteryx.
GRALLATORES (*Waders*)—Rails, Storks, Cranes, Herons.
NATATORES (*Swimmers*)—Divers, Gulls, Ducks, &c.

III. REPTILIA, sub-divided into Reptiles Proper and Batrachians.

1. REPTILES PROPER.

CHELONIA (*Tortoises*)—Turtles, Tortoises.
LORICATA (*Covered with Scutes*)—Crocodile, Gavial, Alligator.
SAURIA (*Lizards*)—Lizard, Iguana, Chameleon.
OPHIDIA (*Serpents*)—Vipers, Snakes, Boas, &c.

2. BATRACHIANS or FROGS.

ANOURA (*Tail-less*)—Toad, Frog, Tree-frog.
URODELA (*Tailed*)—Siren, Triton, Salamander.
APODA (*Footless*)—Lepidosiren, Blindworm.

IV. PISCES or FISHES.

SELACHIA (*Cartilaginous*)—Chimæra, Sharks, Sawfish, Rays.
GANOIDEA (*Enamel-scales*)—Amia, Bony-pike, Sturgeon.
TELEOSTIA (*Perfect-bones*)—Eels, Salmon, Herring, Cod, Pike, &c.
CYCLOSTOMATA (*Circle-mouths*)—Lamprey.
LEPTOCARDIA (*Slender-hearts*)—Amphioxus.

INVERTEBRATA,

Or animals void of back-bone and bony skeleton, and comprehending

ARTICULATA, MOLLUSCA, RADIATA, and PROTOZOA.

I. ARTICULATA, sub-divided into Articulates and Vermes.

1. ARTICULATA or Jointed Animals Proper.

INSECTA (*Insects*)—Beetles, Butterflies, Flies, Bees.
MYRIAPODA (*Many-feet*)—Scolopendra, Centipedes.
ARACHNIDA (*Spiders*)—Spiders, Scorpions, Mites.
CRUSTACEA (*Crust-clad*)—Crayfish, Crabs, Shrimps, Woodlice.
CIRRHOPODA (*Curl-feet*)—Acorn-shells, Barnacles.

2. VERMES or Worms Proper.

ANNELIDA (*Small rings*)—Lobworm, and almost all the marine worms.
ROTIFERA (*Wheel-bearers*)—Rotifers, Hydatina.
GEPHYRIA (*Intermediates—urchin-like*)—Sipunculus, Echinurus.
LUMBRICINA (*Earth-worms*)—Earth-worms, Nais.
HIRUDINEI (*Leeches*)—Leeches, Branchellion.
TURBELLARIA (*Turbellaries*)—Planaria, Ribbon-worms.
HELMINTHES (*Gut-worms*)—Intestinal worms.

II. MOLLUSCA, sub-divided into Mollusca and Molluscoida.

1. Mollusca or Shell-fish Proper.

Cephalopoda (*Head-footed*)—Cuttle-fish, Octopus, Calamary, Nautilus.
Pteropoda (*Wing-footed*)—Clio, Hyalæa.
Gasteropoda (*Belly-footed*)—Snails, Slugs, Whelks, Cowries.
Acephala (*Headless*)—Oysters, Mussels, Cockles, Shipworms.
Brachiopoda (*Arm-footed*)—Terebratula, Lingula.

2. Molluscoida, or Mollusc-like Animals.

Tunicata (*Coated, but Shell-less*)— Biphora, Simple and Compound Ascidians.
Polyzoa (*Compound animals*) or Bryozoa (*Moss-like animals*)—Flustra, Eschara, Plumatella, &c.

III. RADIATA or ZOOPHYTES—Ray-like Animals.

Echinodermata (*Urchin-skinned*)—Sea-urchins, Star-fishes.
Acalephæ (*Sea-nettles*)—Jelly-fish, Beroes.
Polypi (*Many-feet*)—Coral animals, Sea-anemones, Hydras.

IV. PROTOZOA or LOWEST-LIFE—Globular Animals.

Infusoria (*Infusories*)—Monads, Volvoces, Vorticella.
Porifera (*Pore-bearers*)—Sponges, Fresh-water Sponges.
Rhizopoda (*Root-footed*)—Amœba, Polythalamia (Formaniferæ).

The following tabulations exhibit, in detail, the orders, families, and genera of those Classes which come most frequently under the notice of the Palæontologist, in order that the reader may perceive, at a glance, the relation which the extinct forms already determined bear to those still existing, and thus be in some measure enabled to arrive at broader conceptions of the great creational scheme of vitality :—

MAMMALIA.

Sub-class I. PLACENTALIA—bringing forth perfect young.

Order I. BIMANA .... Man.
Sub-fossil—in recent formations only.

Order II. QUADRUMANA.

Fam. 1.	Galeopithecidæ ...	Flying Lemurs.	
Fam. 2.	Chiromydæ	Aye-Ayes.	
Fam. 3.	Tarsidæ...............	Thumbed Lemurs.	Prosimiæ.
Fam. 4.	Nycticebidæ.........	Slow Lemurs.	
Fam. 5.	Lemuridæ............	Lemurs.	
Fam. 6.	Hepalidæ	Marmosets.	Simiæ.
Fam. 7.	Cebidæ	New World Apes.	
Fam. 8.	Simiidæ...............	Old World Apes.	

Fossil Forms.—*Pliopithecus*, *Dryopithecus*, *Mesopithecus*, and species of the existing genus *Macacus*.

Order III. CHEIROPTERA.

Fam. 1. Vespertilionidæ ... True Bats.
Fam. 2. Rhinolophidæ ...... Horse-shoe Bats.
Fam. 3. Phyllostomidæ...... Vampyre Bats.
Fam. 4. Pteropodidæ ...... Fox Bats.

Fossil Forms.—Species of *Vespertilio*, *Rhinolophus*, and other existing genera in bone-caves.

Order IV. INSECTIVORA.

Fam. 1. Talpidæ............... Moles.
Fam. 2. Soricidæ .... Shrews.
Sub-fam. Soricinæ .... True Shrews.
,, Macroscelidinæ... Longlegged Shrews.
,, Erinaceinæ ...... Hedgehogs.
,, Tupainæ .... Banxrings.

Fossil Forms.—*Palæospalax*, *Spalacodon*, *Spalacotherium*, and species of the existing genera *Talpa* and *Sorex*.

Order V. CARNIVORA.

Fam. 1.	Canidæ	Dogs.	Digitigrade.
Fam. 2.	Felidæ	Cats.	
Fam. 3.	Hyænidæ	Hyænas.	

Fam. 4.	Viverridæ	Civets.	Semiplantigrade.
Fam. 5.	Mustelidæ	Weasels.	
Fam. 6.	Melidæ	Badgers.	Plantigrade.
Fam. 7.	Ursidæ	Bears.	
Fam. 8.	Cercoleptidæ	Kinkajous.	

Fossil Forms.—*Machairodus, Galecynus,* and species of the existing genera *Canis, Vulpes, Felis, Hyæna, Putorius, Meles, Ursus,* &c.

Order VI. PINNIPEDIA.

Fam. 1. Phocidæ .... Seals.
Fam. 2. Trichecidæ .... Walruses.

Fossil Forms.—Species of existing genus, *Phoca.*

Order VII. RODENTIA.

Fam. 1. Leporidæ .... Hares.
Fam. 2. Cavidæ .... Cavies.
Fam. 3. Hystricidæ......... Porcupines.
Fam. 4. Castoridæ .... Beavers.
Fam. 5. Muridæ .... Rats.
Fam. 6. Psammorychidæ Sand-Rats.
Fam. 7. Georychidæ ...... Mole-Rats.
Fam. 8. Chinchillidæ ...... Chinchillas.
Fam. 9. Dipopidæ .... Jerboas.
Fam. 10. Myoxidæ............ Dormice.
Fam. 11. Sciuridæ .... Squirrels.

Fossil Forms.—*Trogontherium,* and species of existing genera *Arvicola, Castor, Lagomys, Lepus* and *Mus.*

Order VIII. EDENTATA.

Fam. 1. Myrmecophagidæ...Ant-eaters.
Fam. 2. Dasypodidæ......... Armadilloes.
Fam. 3. Bradypodidæ ...... Sloths.

Fossil Forms.—*Glyptodon, Megatherium, Megalonyx, Mylodon, Macrotherium, Scelidotherium,* &c.

Order IX. RUMINANTIA.

Fam. 1. Camelidæ .... Camels, Llamas.
Fam. 2. Moschidæ .... Musk-deers.
Fam. 3. Cervidæ............... Deers.
Fam. 4. Camelopardidæ ... Giraffe.
Fam. 5. Bovidæ .... Oxen, sheep, antelopes.

Fossil Forms.—Several species of ox, sheep, goat; *Megaceros;* species of musk-deer; species of camel, *Macrauchenia, Sivatherium, Merycotherium,* &c.

Order X. SOLIDUNGULA or SOLIPEDIA.

Fam. 1. Equidæ .... Horses, asses, zebras.

Fossil Forms.—Species of the existing genera *Equus* and *Asinus.*

Order XI. PACHYDERMATA.

Fam. 1.	Elephantidæ	Elephants.	Proboscidea.
Fam. 2.	Tapiridæ	Tapirs.	
Fam. 3.	Hippopotamidæ	Hippopotami.	
Fam. 4.	Rhinoceridæ	Rhinoceroses.	
Fam. 5.	Suidæ	Swine.	
Fam. 6.	Hyracidæ	Conies.	

Fossil Forms.—*Mammoth*, *Mastodon*; *Palæotherium*, *Paloplotherium*, *Anoplotherium*; *Hyopotamus*, *Chœroptamus*, *Microchœrus*; *Dichobune*, *Coryphodon*, *Dichodon*; *Hyracotherium*; and several species of existing genera.

Order XII. CETACEA.

Sub-order I. CETE.

Fam. 1.	Balænidæ	True Whales.	Zoophagous.
Fam. 2.	Physeteridæ	Sperm Whales.	
Fam. 3.	Delphinidæ	Dolphins.	

Sub-order II. SIRENIA.

Fam. 1.	Rhytinidæ	Rhytines.	Phytophagous.
Fam. 2.	Manatidæ	Sea-cows.	

Fossil Forms.—*Balænodon*, *Zeuglodon*, *Squalodon*; *Halitherium*, *Dinotherium* (?); and sub-fossil species of existing genera.

Sub-class II. APLACENTALIA—bringing forth imperfect young.

Order I. MARSUPIALIA.

Fam. 1.	Phascolomydæ	Wombats.	Phytophagous.
Fam. 2.	Macropodidæ	Kangaroos.	
Fam. 3.	Phalangistidæ	Phalangers.	
Fam. 4.	Peramelidæ	Bandicoots.	Rapacious.
Fam. 5.	Didelphidæ	Opossums.	
Fam. 6.	Myrmecobiidæ	Banded Ant-Eaters.	
Fam. 7.	Dasyuridæ	Dasyures.	

Fossil Forms.—*Amphitherium*, *Phascolotherium*, *Triconodon*, *Plagiaulax*, *Microlestes*, *Amphilestes*, *Nototherium*, *Diprotodon*, *Zygomaturus*, *Thylacoleo*; and sub-fossil species of existing genera.

Order II. MONOTREMATA.

Fam. 1.	Ornithorhyncidæ	Ornithorhynchus.
Fam. 2.	Echidnidæ	Porcupine Ant-Eaters.

REPTILIA.

(*The fossil orders and sub-orders after Professor Owen.*)

Sub-class I. REPTILIA, OR REPTILES PROPER.

Order I. CHELONIA.

Fam. 1. Chelonidæ ....Turtles ....Marine.
Fam. 2. Tryonicidæ ....Soft Tortoises ....Fluvial.
Fam. 3. Emydidæ ....Box Tortoises ....Marsh.
Fam. 4. Testudinidæ............Land Tortoises ....Terrestrial.

Fossil Forms.—*Colossochelys, Pleurosternon, Protemys, Platemys;* fossil footprints, as *Chelichnus,* &c.; and species of the existing genera *Chelone, Tryonyx,* and *Emys.*

Order II. CROCODILIA or LORICATA.

Sub-order 1. Procœlia ....Having concavo-convex vertebræ.
Fossil 2. Amphicœlia...........Having bi-concave vertebræ.
Fossil 3. Opisthocœlia ....Having convexo-concave vertebræ.

Fossil Forms.—1. Specific forms of the existing genera *Crocodilus, Alligator* and *Gavialis;* 2. *Teleosaurus, Steneosaurus, Suchosaurus, Goniopholis,* &c.; 3. *Cetiosaurus, Streptospondylus,* &c.

Order III. SAURIA.

Sub-order I. LACERTILIA or SQUAMATA.

Fam. 1. Scincidæ.................Skinks.
Fam. 2. Chalcidæ ....
Fam. 3. Lacertidæ ....Lizards.
Fam. 4. Teidæ ....Ameivas.
Fam. 5. Varanidæ ....Varanas.
Fam. 6. Iguanidæ ....Iguanas.
Fam. 7. Geckotidæ ....Geckos.
Fam. 8. Chamæleonidæ ....Chameleons.

Fossil Forms.—*Telerpeton, Leiodon, Palæosaurus, Macellodus, Lacerta, Coniosaurus, Dolichosaurus,* &c.

Sub-order II. THECODONTIA (Sheath-teeth).

Fossil.—*Thecodontosaurus, Protorosaurus, Cladyodon, Belodon,* &c.

Sub-order III. CRYPTODONTIA (Concealed-teeth).

Fossil.—*Rhyncosaurus, Oudenodon,* &c.

Sub-order IV. DICYNODONTIA (Two-canine-teeth).

Fossil.—Dicynodon (various species).

Sub-order V. Pterosauria (Winged Saurians).

Fossil.—*Pterodactylus, Dimorphodon, Ramphorhynchus,* &c.

Sub-order VI. Dinosauria (Huge Land-Saurians).

Fossil. —*Iguanodon, Megalosaurus, Hylæosaurus, Regnosaurus,* &c.

Sub-order VII. Enaliosauria (Marine Saurians).

Fossil.—*Ichthyosaurus, Plesiosaurus, Pliosaurus, Simosaurus, Nothosaurus,* &c.

Order IV. Ophidia.

Fam. 1. Crotalidæ ....Rattlesnakes.
Fam. 2. Viperidæ ....Vipers.
Fam. 3. Colubridæ ....Snakes.
Fam. 4. Hydrophidæ ....Water-Snakes.
Fam. 5. Dendrophidæ ....Tree-Snakes.
Fam. 6. Boidæ ....Boas.

Fossil Forms. —*Palæophis, Laophis, Paleryx;* detached bones and eggs of undetermined genera.

Sub-class II. BATRACHIA OR AMPHIBIA.

Order I. Apoda.

Fam. 1. Cœciliidæ.....................Blindworms.
Fam. 2. Lepidotidæ ....Lepidosiren.

Order II. Urodela.

Fam. 1. Proteidæ ....Proteus.
Fam. 2. Sirenidæ ....Sirens.
Fam. 3. Amphiumidæ ....Amphiuma.
Fam. 4. Salamandridæ...............Tritons.

Fossil Forms. —*Archægosaurus* or *Apateon, Dendrerpeton, Palæophrynos, Andrias,* &c.

Order III. Anura.

Fam. 1. Pipidæ ....Surinam Toads.
Fam. 2. Bufonidæ ....Toads.
Fam. 3. Ranidæ ....Frogs.

Sub-fam.—Hylineæ ....Tree-Frogs.

Fossil Forms.—*Raniceps; Batrachopus, Sauropus,* and other frog-like footprints.

Order IV. Labyrinthodontia (Labyrinthine-teeth).

Fossil. —*Labyrinthodon, Parabatrachus, Baphetes, Zygosaurus, Odontosaurus,* &c.

PISCES OR FISHES.

(*Chiefly from Morris's Catalogue of British Fossils, as modified from Müller and Owen.*)

Class PISCES.

Order I. DERMOPTERI. [*Cycloidei*, Agass.]

Sub-order I. Pharyngobranchii, seu *Cirrhostomi.*

Fam. 1. Amphioxidæ.....................Lancelet.

Sub-order II. Marsipobranchii. [*Cyclostomi*, Cuv.]

Fam. 1. Myxinidæ..........................Myxine.
Fam. 2. Petromyzontidæ ....Lamprey.

Order II. MALACOPTERI (*Physostomi*, Müller). [*Cycloidei*, Agass.]

Sub-order I. M. apodes.

Fam. 1. Symbranchidæ..................Cuchia.
Fam. 2. Murænidæ........................Eel.
Fam. 3. Gymnotidæ ....Gymnotus.

Sub-order II. M. abdominales.

Fam. 1. Heteropygii ....Amblyopsis.
Fam. 2. Clupeidæ........................Herring.
Fam. 3. Salmonidæ ....Salmon.
Fam. 4. Scopelidæ ....Saurus.
Fam. 5. Characinidæ ....Myletes.
Fam. 6. Galaxidæ........................Galaxias.
Fam. 7. Esocidæ ....Pike.
Fam. 8. Mormyridæ.....................Mormyrus.
Fam. 9. Cyprinodontidæ...............Umber.
Fam. 10. Cyprinidæ ....Carp.
Fam. 11. Siluridæ ....Sheat-fish.

Order III. PHARYNGOGNATHI (*Müller*). [*Cycloidei et Ctenoidei*, Agass.]

Sub-order I. Ph. malacopterygii.

Fam. 1. Scomber-esocidæ...............Saury-Pike.

Sub-order II. Ph. acanthopterygii.

Fam. 1. Chromidæ........................Chromis.
Fam. 2. Cyclo-labridæ ....Wrasse.
Fam. 3. Cteno-labridæ ....Pomacentrus.

Order IV. ANACANTHINI (*Müller*). [*Cycloidei et Ctenoidei*, Agass.]

Sub-order I. A. apodes.

Fam. 1. Ophididæ ....Ophidium.

Sub-order II. A. thoracici.

Fam. 1. Gadidæ ....Cod.
Fam. 2. Pleuronectidæ ....Plaice.

Order V. ACANTHOPTERI (*Müller*). [*Cycloidei et Ctenoidei*, Agass.]

Fam. 1. Percidæ ....Perch.
Fam. 2. Sclerogenidæ ....Gurnard.
Fam. 3. Sparidæ ....Sparus.
Fam. 4. Sciænidæ ....Maigre.
Fam. 5. Labyrinthobranchii ....Anabas.
Fam. 6. Mugilidæ ....Mullet.
Fam. 7. Notacanthidæ ....Notacanth.
Fam. 8. Scomberidæ ....Mackerel.
Fam. 9. Squammipennes ....Chætodon.
Fam. 10. Tænioidei ....Riband-fish.
Fam. 11. Theutyidæ ....Lancet-fish.
Fam. 12. Fistularidæ ....Pipe-mouth.
Fam. 13. Gobiidæ ....Goby.
Fam. 14. Blenniidæ ....Wolf-fish.
Fam. 15. Lophiidæ ....Angler.

Order VI. PLECTOGNATHI (*Cuvier*). [*Ganoidei*, Agass.]

Fam. 1. Balistini ....File-fish.
Fam. 2. Ostraciontidæ ....Trunk-fish.
Fam. 3. Gymnodontidæ...................Globe-fish.

Order VII. LOPHOBRANCHII (*Cuvier*). [*Ganoidei*, Agass.]

Fam. 1. Hippocampidæ ....Sea-horse
Fam. 2. Syngnathidæ.....................Pipe-fish.

Order VIII. GANOIDEI, seu *Goniolepidoti* (*Agass.*; as restricted by *Müller*).

Chiefly Fossil Forms.

Fam. 1. Salamandroidei ....Lepidosteus and Polypterus. (Sauroidei, *Agass.*)
Fam. 2. Pycnodontidæ ....Pycnodus.
Fam. 3. Lepidoidei ....Dapedius.
Fam. 4. Sturionidæ ......Sturgeon. (Acipenserini, *Agass.*)
Fam. 5. Acanthodei ....Acanthodes.
Fam. 6. Dipteridæ ....Dipterus. (Sauroidei-dipterini, *Agass.*)
Fam. 7. [Cœlacanthi, *Agass* ....Cœlacanthus.]
Fam. 8. Cephalaspides ....Cephalaspis.

Order IX. PROTOPTERI. [*Ganoidei*, Agass.]

Fam. 1. Sirenoidei ....Lepidosiren.

Order X. HOLOCEPHALI. [*Placoidei*, Agass.]

Fam. 1. Chimæridæ ....Chimæra.
Fam. 2. Edaphodontidæ ....Edaphodon.

Order XI. PLAGIOSTOMI. [*Placoidei,* Agass.]

Fam. 1.	Hybodontidæ	Hybodus.
Fam. 2.	Cestraciontidæ	Cestracion.
Fam. 3.	Notidanidæ	Grey Shark.
Fam. 4.	Spinacidæ	Piked Dog-fish.
Fam. 5.	Scylliadæ	Spotted Dog-fish.
Fam. 6.	Nictitantes	Tope.
Fam. 7.	Lamnidæ	Porbeagle.
Fam. 8.	Alopecidæ	Fox Shark.
Fam. 9.	Scymniidæ	Greenland Shark.
Fam. 10.	Squatinæ	Monk-fish.
Fam. 11.	Zygænidæ	Hammer-head Shark.
Fam. 12.	Pristidæ	Saw-fish.
Fam. 13.	Rhinobatidæ	Rhinobates.
Fam. 14.	Torpedinidæ	Electric Ray.
Fam. 15.	Raiidæ	Skate.
Fam. 16.	Trygonidæ	Sting Ray.
Fam. 17.	Myliobatidæ	Eagle Ray.
Fam. 18.	Cephalopteridæ	Cephalopterus.

CRUSTACEA.

(*Extinct Families and Genera are printed in italics.*)

Sub-Class I.—ENTOMOSTRACA.

Legion 1. LOPHYROPODA.

Order 1. COPEPODA.

Fam. 1. Cyclopidæ.

Order 2. OSTRACODA.

Fam. 1. Cyprididæ.
Genus Cypris.
Candona.
Cypridea.

Fam. 2. Cytheridæ.
Genus Cythere.
Sub-genus Bairdia.
Cytheridæ.
Cythereis.
Cytherella.

Fam. 3. Cypridinidæ.

Genus Cypridina.
Cypridella.
Cyprella.
Daphnoidea.

Legion 2. BRANCHIOPODA.

Order 1. CLADOCERA.

Fam. 1. Daphniadæ.
Genus Daphnia, &c.

Order 2. PHYLLOPODA.

Fam. 1. Limnadiadæ.
Genus Limnadia.
Estheria.
Leperditia.
Beyrichia.

Fam. 2. Nebaliadæ.
Genus Nebalia.
Ceratiocaris.
Hymenocaris.
Kampecaris.

Fam. 3. Apodidæ.
Genus Apus.
Dithyrocaris.

Fam. 4. Branchiopodidæ.
Genus Cheirocephalus, &c.

Extinct Group. *Trilobitæ.*
Harpedidæ.
Paradoxidæ.
Proëtidæ.
Asaphidæ.
Phacopidæ.
Calymenidæ.
Lichadidæ.
Trinucleidæ.
Acidaspidæ.
Cheiruridæ.
Bronteidæ.
Agnostidæ.

Legion 3. PŒCILOPODA.

Fam. 1. Limulidæ.
Genus Limulus, &c.

Extinct Fam. 2. *Eurypteridæ.*
Genus *Eurypterus.*
Pterygotus.
Erettopterus.
Stylonurus.

Legion 4. SIPHONOSTOMATA.

Sub-Class II.—MALACOSTRACA.

Legion 1. PODOPHTHALMIA.

Order 1. DECAPODA.

Fam. 1. Brachyura=Crabs, &c.

Fam. 2. Anomura=Hermit Crab, &c.

Fam. 3. Macrura=Lobster, &c.

Order 2. STOMAPODA=Squills, &c.

Legion 2. EDRIOPHTHALMIA.

Order 1. AMPHIPODA=Gammarus, &c.

Order 2. LŒMIPODA = Caprella, &c.

Order 3. ISOPODA=Oniscus, &c.

MOLLUSCA.

(Modified from Woodward's Manual,—the fossil families and genera being printed in Italics.)

CLASS I.—CEPHALOPODA.

ORDER I. DIBRANCHIATA = ACETABULIFERA.

a. OCTOPODA.

Fam. 1. Argonautidæ.—Argonauta.
Fam. 2. Octopodidæ.—Octopus, Pinnoctopus, Eledone, Cirroteuthis, Philonexis.

b. DECAPODA.

Fam. 3. Teuthidæ.—Loligo, Gonatus, Sepioteuthis, *Beloteuthis, Geoteuthis, Leptoteuthis,* Cranchia, Sepiola, Loligopsis, Cheiroteuthis, Onychoteuthis, Enoploteuthis, Ommastrephes.
Fam. 4. *Belemnitidæ.—Belemnites, Belemnitella, Acanthoteuthis, Belemnoteuthis, Conoteuthis.*
Fam. 5. Sepiadæ.—Sepia, *Spirulirostra, Beloptera, Belemnosis.*
Fam. 6.—Spirulidæ.—Spirula.

ORDER II. TETRABRANCHIATA = TENTACULIFERA.

Fam. 1. Nautilidæ.—Nautilus, *Lituites, Trochoceras, Clymenia.*
Fam. 2. *Orthoceratidæ.—Orthoceras, Gomphoceras, Oncoceras, Phragmoceras, Cyrtoceras, Gyroceras, Ascoceras.*
Fam. 3. *Ammonitidæ.—Goniatites, Bactrites, Ceratites, Ammonites, Crioceras, Turrilites, Hamites, Ptychoceras, Baculites.*

CLASS II.—PTEROPODA.

a. THECOSOMATA.

Fam. 1. Hyaleidæ.—Hyalea, Cleodora, Cuvieria, *Theca, Pterotheca, Conularia,* Eurybia, Cymbulia, Tiedemannia.
Fam. 2. Limacinidæ.—Limacina, Spirialis.

b. GYMNOSOMAIA.

Fam. 3. Cliidæ.—Clio, Pneumodermon, Pelagia, Cymodocea.

CLASS III.—GASTEROPODA.

ORDER I. PROSOBRANCHIATA.

a. SIPHONOSTOMATA.

Fam. 1. Strombidæ.—Strombus, Pteroceras, Rostellaria, Seraphs.
Fam. 2. Muricidæ.—Murex, Pisania, Ranella, Triton, Fasciolaria, Turbinella, Cancellaria, Trichotropis, Pyrula, Fusus.

Fam. 3. Buccinidæ.—Buccinum, Pseudoliva, Anolax, Halia, Terebra, Eburna, Nassa, Phos, Ringicula?, Purpura, *Purpurina*, Monoceros, Pedicularia, Ricinula, Planaxis, Magilus, Cassis, Oniscia, Cithara, Cassidaria, Dolium, Harpa, Columbella, Oliva, Ancillaria.

Fam. 4. Conidæ.—Conus, Pleurotoma.

Fam. 5. Volutidæ.—Voluta, Cymba, Mitra, *Volvaria*, Marginella.

Fam. 6. Cypræidæ.—Cypræa, Erato, Ovulum.

b. Holostomata.

Fam. 1. Naticidæ.—Natica, Sigaretus, Lamellaria, Narica, Velutina.

Fam. 2. Pyramidellidæ.—Pyramidella, Odostomia, Chemnitzia, Eulima, Stylina, *Loxonema, Macrocheilus.*

Fam. 3. Cerithiadæ.—Cerithium, Potamides, *Nerinæa,* Fastigiella, Aporrhais, Struthiolaria.

Fam. 4. Melaniadæ.—Melania, Paludomus, Melanopsis.

Fam. 5. Turritellidæ.—Turritella, Aclis, Cæcum, Vermetus, Siliquaria, Scalaria.

Fam. 6. Litorinidæ.—Litorina, Solarium, Phorus, Lacuna, Litiopa, Rissoa, Skenea, Truncatella?, Lithoglyphus.

Fam. 7. Paludinidæ.—Paludina, Ampullaria, Amphibola, Valvata.

Fam. 8. Neritidæ.—Nerita, Pileolus, Neritina, Navicella.

Fam. 9. Turbinidæ.—Turbo, Phasianella, Imperator, Trochus, Rotella, Monodonta, Delphinula, Adeorbis, *Euomphalus,* Stomatella, Broderipia.

Fam. 10. Haliotis.—Haliotis, Stomatia, Scissurella, *Pleurotomaria, Murchisonia, Trochotoma, Cirrus,* Ianthina.

Fam. 11. Fissurellidæ.—Fissurella, Puncturella, Rimula, Emarginula, Parmophorus.

Fam. 12. Calyptræidæ.—Calyptræa, Crepidula, Pileopsis, Hipponyx.

Fam. 13. Patellidæ.—Patella, Acmæa, Gadinia, Siphonaria.

Fam. 14. Dentaliadæ.—Dentalium.

Fam. 15. Chitonidæ.—Chiton.

Order II. Pulmonifera.

a. Inoperculata.

Fam. 1. Helicidæ.—Helix, Vitrina, Succinea, Bulimus, Achatina, Pupa, Cylindrella, Balea, Tornatellina, Paxillus, Clausilia.

Fam. 2.—Limacidæ.—Limax, Incilaria, Arion, Parmacella, Testacella.

Fam. 3. Oncidiadæ.—Oncidium, Vaginulus.

Fam. 4.—Limnæidæ.—Limnæa, Chilinia, Physa, Ancylus, Planorbis.

Fam. 5. Auriculidæ.—Auricula, Conovulus, Carychium (Siphonaria).

b. Operculata.

Fam. 6. Cyclostomidæ.—Cyclostoma, *Ferussina?* Cyclophorus, Pupina, Helicina, Stoastoma.

Fam. 7. Aciculidæ.—Acicula, Geomelania.

ORDER III.—OPISTHO-BRANCHIATA.

a. TECTIBRANCHIATA.

Fam. 1. Tornatellidæ.—Tornatella, *Cinulia,* Ringicula, Globiconcha, Varigera, *Tylostoma, Pterodonta?,* Tornatina?

Fam. 2. Bullidæ.—Bulla, Acera, Cylichna, Amphisphyra, Aplustrum, Scaphander, Bullæa, Doridium, Gastropteron.

Fam. 3. Aplysiadæ.—Aplysia, Dolabella, Notarchus, Icarus, Lobiger.

Fam. 4. Pleurobranchidæ.—Pleurobranchus, Posterobranchæa, Runcina, Umbrella, Tylodina.

Fam. 5. Phyllidiadæ.—Phyllidia, Diphyllidia.

b. NUDIBRANCHIATA.

Fam. 6. Doridæ.—Doris, Goniodoris, Triopa, Ægirus, Thecacera, Polycera, Idalia, Ancula, Ceratosoma.

Fam. 7. Tritoniadæ.—Tritonia, Scyllæa, Tethys, Bornella, Dendronotus, Doto, Melibæa, Lomanotus.

Fam. 8. Æolidæ.—Æolis, Glaucus, Fiona, Embletonia, Proctonotus, Antiopa, Hermæa, Alderia.

Fam. 9. Phyllirhoidæ.—Phyllirhoe.

Fam. 10. Elysiadæ.—Elysia, Acteonia, Cenia, Limapontia.

ORDER IV. NUCLEOBRANCHIATA.

Fam. 1. Firolidæ.—Firola, Carinaria, Cardiapoda.

Fam. 2. Atlantidæ.—Atlanta, *Porcellia, Bellerophon, Cyrtolites, Maclurea.*

CLASS IV.—ACEPHALA = CONCHIFERA.

a. ASIPHONIDA.

Fam. 1. Ostreidæ.—Ostrea, Anomia, Placuna, Pecten, Lima, Spondylus, Pedum, Plicatula.

Fam. 2. Aviculidæ.—Avicula, *Posidonomya, Aviculo-pecten, Gervillia,* Perna, *Inoceramus,* Pinna.

Fam. 3. Mytilidæ. — Mytilus, *Myalina,* Modiola, Lithodomus, Crenella, Dreissena.

Fam. 4. Arcadæ.—Arca, Cucullæa, Pectunculus, Limopsis, Nucula, Isoarca, Leda, Solenella, Solemya.

Fam. 5. Trigoniadæ.—Trigonia, *Myophoria, Axinus, Lyrodesma.*

Fam. 6. Unionidæ.—Unio, Castalia, Anodon, Iridina, Mycetopus, Ætheria, Mülleria.

b. SIPHONIDA; Integro-pallialia.

Fam. 7. Chamidæ.—Chama, Monopleura, *Diceras, Requienia.*

Fam. 8. *Hippuritidæ.—Hippurites, Radiolites, Caprinella, Caprina, Caprotina.*

Fam. 9. Tridacnidæ.—Tridacna, Hippopus.

Fam. 10. Cardiadæ.—Cardium, Hemicardium, *Lithocardium,* Serripes, Adacna, *Conocardium.*

Fam. 11. Lucinidæ.—Lucina, Cryptodon, Corbis, Tancredia, Diplodonta, Ungulina, Kellia, Montacuta, Lepton, Galeomma.

Fam. 12. Cycladidæ.—Cyclas, Cyrenoides, Cyrena.

Fam. 13. Cyprinidæ.—Cyprina, Circe, Astarte, Crassatella, Iso-

cardia, Cypricardia, *Pleurophorus*, *Cardilia*, *Megalodon*, *Pachydomus*, *Pachyrisma*, *Opis*, *Cardinia*, *Myoconcha*, Hippopodium, Cardita, Venericardia, Verticordia.

c. SIPHONIDA ; sinu-pallialia.

Fam. 14. Veneridæ.—Venus, Cytherea, *Meroe*, Trigona, Grateloupia, Artemis, Lucinopsis, Tapes, Venerupis, Petricola, Glaucomya.

Fam. 15. Mactridæ.—Mactra, Gnathodon, Lutraria, Anatinella.

Fam. 16. Tellinidæ. — Tellina, Diodonta, Capsula, Psammobia, Sanguinolaria, Semele, Syndosmya, Scrobicularia, Mesodesma, Ervilia, Donax, Galatea.

Fam. 17. Solenidæ.—Solen, Cultellus, Ceratisolen, Machæra, Solecurtus, Novaculina.

Fam. 18. Myacidæ.—Mya, Corbula, Sphenia, Neæra, Thetis, Panopæa, Saxicava, Glycimeris.

Fam. 19. Anatinidæ. — Anatina, Cochlodesma, Thracia, *Pholadomya*, *Myacites*, *Goniomya*, *Ceromya*, *Cardiomorpha*, *Edmondia*, Lyonsia, Pandora, Myadora, Myochama, Chamostrea.

Fam. 20. Gastrochænidæ.—Gastrochæna, Chæna, Clavagella, Aspergillum.

Fam. 21. Pholadidæ.—Pholas, Pholadidea, Jouannetia, Xylophaga, Teredo, Teredina.

CLASS V.—BRACHIOPODA.

Fam. 1. Terebratulidæ.—Terebratula, Terebratella, Argiope, Thecidium, *Stringocephalus*.

Fam. 2. *Spiriferidæ.—Spirifera, Athyris, Retzia, Uncites.*

Fam. 3. Rhynchonellidæ.—Rhynchonella, *Camarophoria*, *Pentamerus*, *Atrypa*.

Fam. 4. *Orthidæ. — Orthis, Strophomena, Leptæna, Koninckia, Davidsonia, Calceola.*

Fam. 5. *Productidæ.—Producta, Aulosteges, Strophalosia, Chonetes.*

Fam. 6. Craniadæ.—Crania.

Fam. 7. Discinidæ.—Discina, *Siphonotreta*.

Fam. 8. Lingulidæ.—Lingula, *Obolus*.

MOLLUSCOIDA.

CLASS I.—TUNICATA : doubtfully known in a fossil state.

CLASS II.—BRYOZOA or POLYZOA.

Fam. 1. Escharidæ.—Eschara, *Ptilodictya*, *Glauconome*.

Fam. 2. Celleporidæ.—Cellepora, Flustra, Lepralia.

Fam. 3. Reteporidæ.—Retepora, *Fenestella*, *Polypora*.

Fam. 4. Crisidæ.—Crisia, *Idmonea*, *Hippothoa*.

Fam. 5. *Myriaporidæ.—Fascicularia, Terebellaria, Theonoa.*

Fam. 6. Tubuliporidæ.—Tubulipora, *Heteropora*, *Ceriopora*.

ECHINODERMATA.

(Fossil Families and Examples printed in Italics.)

Order I. CRINOIDEA.

Examples.

Fam. 1. Comatulidæ ....Comatula.
Fam. 2. *Marsupitidæ*...............*Marsupites.*
Fam. 3. *Apiocrinidæ* ....*Apiocrinus, Bourgueticrinus.*
Fam. 4. Pentacrinidæ...............Pentacrinus, *Extracrinus.*
Fam. 5. *Cyathocrinidæ* ....*Cyathocrinus, Poteriocrinus, Rhodocrinus.*
Fam. 6. *Melocrinidæ* ....*Actinocrinus, Hexacrinus, Platycrinus.*
Fam. 7. *Cupressocrinidæ* ....*Cupressocrinus.*
Fam. 8. *Polycrinidæ* ....*Eucalyptocrinus.*

Order II. CYSTOIDEA.

Fam. 1. *Cystidæ* ....*Pseudocrinites, Hemicosmites.*

Order III. BLASTOIDEA.

Fam. 1. *Pentremitidæ* ....*Pentremites, Codonaster.*

Order IV. OPHIUROIDEA.

Fam. 1. Ophiuridæ ....Ophiura, *Amphiura, Ophioderma.*

Order V. ASTEROIDEA.

Fam. 1. Asteridæ ....Asterias, Goniaster, Oreaster.
Fam. 2. Crenasteridæ..............Crenaster, Euryale.

Order VI. PERISCHO-ECHINOIDEA.

Fam. 1. *Palæchinidæ* ....*Palæchinus.*
Fam. 2. *Archæocidaridæ* ....*Archæocidaris, Perischodonus.*

Order VII. ECHINOIDEA.

Fam. 1. Echinidæ ....Echinus, *Diadema, Hemiaster.*
Fam. 2. Cidaridæ.....................Cidaris.
Fam. 3. *Galeritidæ* ....*Galerites, Dysaster, Holectypus.*
Fam. 4. *Echinoneidæ* ....*Echinocyamus, Echinarachnius.*
Fam. 5. Cassidulidæ ....Nucleolites, Pygaster.
Fam. 6. *Ananchytidæ*...............*Ananchytes, Cardiaster.*
Fam. 7. Spatangidæ ....Spatangus, *Micraster.*

Order VIII. HOLOTHUROIDEA.

Fam. 1. Holothuridæ ....Holothuria.
Fam. 2. Synaptidæ ....

GEOLOGICAL SCHEME.

All our ideas of geological arrangement are founded on the fact, that in the earth's crust there are two great sets of rocks, the STRATIFIED and the UNSTRATIFIED—the former the results of deposition in water, and hence also known as *Aqueous* and *Sedimentary,* the latter the products of igneous fusion, and consequently termed *igneous* and *eruptive,* thus :—

I. STRATIFIED, SEDIMENTARY, AQUEOUS, or NEPTUNIAN—the results of deposition in water, and consequently arranged in layers or strata more or less persistent and regular, as sandstone, shale, limestone, coal, and the like.

II. UNSTRATIFIED, ERUPTIVE, IGNEOUS, or PLUTONIC—the products of igneous fusion, and cast forth, for the most part, in irregular and amorphous masses, as granite, greenstone, basalt, lava, and the like.

The following arrangement of the STRATIFIED FORMATIONS is that which gave direction and consistency to the researches of British Geologists during the earlier portion of the present century—is still, in part, retained in its nomenclature, and continues less or more to influence our ideas of succession and chronology :—

FORMATIONS.

RECENT.—All superficial accumulations, as sand, gravel, silt, marl, peat-moss, coral reefs, &c. *Contain the remains of existing plants and animals only partially fossilised.*

TERTIARY.—Local and limited deposits of regular strata occurring above the chalk. *Contain the remains of plants and animals not differing widely in character from those now existing.*

SECONDARY.—Embracing all the strata known as chalk, oolite, lias, coal-measures, mountain limestone, and old red sandstone. *Contain fossil plants and animals of species totally different from those now existing.*

TRANSITION.—Strata of slaty and siliceous sandstones, known as "greywackè," calcareous shales, and limestones. *Contain few or no fossil plants, and the remains of no higher animals than crustacea, shell-fish, and zoophytes.*

PRIMARY.—All slaty and crystalline strata—as roofing-slate, mica-schist, and gneiss, very hard and compact, and totally destitute of organic remains.

Although the Igneous rocks burst through and appear among the stratified without order or arrangement, it is customary to speak of them as Granitic, Trappean, and Volcanic; meaning, by the term Granitic, the igneous rocks which, like granite, are usually found associated with the older strata; by the term Trappean, the igneous rocks most frequently associated with the secondary and tertiary strata; and by the term Volcanic, those that have made their appearance during the current epoch. Classifying them according to this view, we have the subjoined tabulation:—

GROUPS.	
	Volcanic.—Lava, trachyte, scoriæ, &c., associated with recent accumulations.
	Trappean.—Trap-tuff, amygdaloid, greenstone, basalt, &c., associated for the most part with tertiary and secondary strata.
	Granitic.—Granite, syenite, porphyry, &c., associated in greatest force with transition and primary strata.

By a more extensive examination of the strata in different countries, and especially by a more minute investigation of their fossil contents, the "formations" of the earlier geologists have, to a certain extent, become obsolete, and other subdivisions and groupings been adopted. This new arrangement has been founded either on mineral or on fossil distinctions—such differences being sufficient to warrant the conclusion that each set of strata was formed during successive epochs, under different distributions of sea and land, and consequently under different conditions of climate and other modifying influences; and as geological investigation advances, it is more than probable that we must still farther abandon our *Rock Formations*, and adhere to great *Life Periods* as the true exponents of the world's progress and history. In the mean time the following arrangement gives consistency to the researches of European and American geologists:—

Systems.	*Periods.*	*Cycles.*
1. Post-Tertiary. 2. Tertiary.	Cainozoic (Recent Life).	NEOZOIC.
3. Cretaceous. 4. Oolitic or Jurassic. 5. Triassic.	Mesozoic (Middle Life).	NEOZOIC.
6. Permian. 7. Carboniferous. 8. Devonian or Old Red. 9. Silurian. 10. Cambrian.	Palæozoic (Ancient Life).	PALÆOZOIC.
11. Metamorphic, Crystalline, or Non-fossiliferous.	Azoic (Void of Life).	PALÆOZOIC.

BRITISH STRATIFIED SYSTEMS.

The following tabulation exhibits the arrangement of the British stratified rocks, as accepted by our leading geologists—minor and local deviations of superposition being subordinated for the sake of distinct comprehension and ready reference :—

Systems.	*Groups.*	*Periods.*	
POST-TERTIARY.	In progress. Recent.	CAINOZOIC.	NEOZOIC CYCLE.
TERTIARY.	Pleistocene. Pliocene. Miocene (?) Eocene.		
CRETACEOUS.	Chalk. Greensand.	MESOZOIC.	
OOLITIC.	Wealden. Oolite. Lias.		
TRIASSIC.	Saliferous marls. Muschelkalk (?) Upper new red sandstone.		
PERMIAN.	Magnesian limestone. Lower new red sandstone.	PALÆOZOIC.	PALÆOZOIC CYCLE.
CARBONIFEROUS.	Coal-measures. Millstone grit. Mountain limestone. Lower coal-measures.		
DEVONIAN.	Yellow sandstones. Devonian limestones and schists. Red conglomerates, sandstones, and cornstones. Grey fissile sandstones, "flagstones," or "tilestones."		
SILURIAN.	Upper silurian. Lower silurian. Cambrian (?)		
METAMORPHIC.	Clay-slate. Mica-schist. Gneiss and Granitoid schists.	AZOIC, OR HYPOZOIC.	

OF VOLCANIC (Post-Tertiary to Cretaceous)

RANGE OF TRAPPEAN ROCKS (Tertiary to Silurian)

RANGE OF GRANITIC ROCKS (Cretaceous to Metamorphic)

TABLE OF EUROPEAN FOSSILIFEROUS STRATA.

(*After Sir Charles Lyell*, 1855.)

1. Recent.	Post-Tertiary.		
2. Post-Pliocene.			
3. Newer Pliocene.	Pliocene.	Tertiary or Cainozoic.	Neozoic.
4. Older Pliocene.			
5. Miocene.	Miocene.		
6. Upper Eocene.	Eocene.		
7. Middle Eocene.			
8. Lower Eocene.			
9. Maestricht Beds.	Cretaceous.	Secondary or Mesozoic.	
10. Upper White Chalk.			
11. Lower White Chalk.			
12. Upper Greensand.			
13. Gault.			
14. Lower Greensand.			
15. Wealden.			
16. Purbeck Beds.	Jurassic.		
17. Portland Stone.			
18. Kimmeridge Clay.			
19. Coral Rag.			
20. Oxford Clay.			
21. Great or Bath Oolite.			
22. Inferior Oolite.			
23. Lias.			
24. Upper Trias.	Triassic.		
25. Middle Trias, or Muschelkalk.			
26. Lower Trias.			
27. Permian, or Magnesian Limestone.	Permian.	Primary or Palæozoic.	Palæozoic.
28. Coal-Measures.	Carboniferous.		
29. Carboniferous Limestone.			
30. Upper / 31. Lower Devonian.	Devonian.		
32. Upper / 33. Lower Silurian.	Silurian.		
34. Upper / 35. Lower Cambrian.	Cambrian.		

AGES GÉOLOGIQUES.

(*After d'Orbigny*, 1852.)

Terrains.	*Étages.*	*British Equivalents.*
EPOQUE ACTUELLE.	,,	CURRENT EPOCH.
TERTIAIRES.	27. Subapennin	Red and Coralline Crag of Suffolk.
	26. Falunien	— —
	25. Parisien	Upper and Middle Eocenes.
	24. Suessonien	Lower Eocene.
	23. Danien	— —
CRÉTACÉS.	22. Sénonien	Upper White Chalk.
	21. Turonien	Lower White Chalk.
	20. Cénomanien	Upper Greensand.
	19. Albien	Gault.
	18. Aptien	Lower Greensand, in part.
	17. Néocomien	Do. and Wealden.
	16. Portlandien	Portland Group.
JURASSIQUES.	15. Kimméridgien	Kimmeridge Clay.
	14. Corallien	Coral Rag.
	13. Oxfordien	Oxford Clay.
	12. Callovien	Kelloway Rock.
	11. Bathonien	Bath Oolite.
	10. Bajocien	Inferior Oolite.
	9. Toarcien	Upper Lias.
	8. Liasien	Middle Lias; Marlstone.
	7. Sinemurien	Lower Lias.
TRIASIQUES.	6. Saliférien	Saliferous Marls.
	5. Conchylien	Variegated Sandstones, in part; Upper New Red.
PALÆOZOIQUES.	4. Permien	Magnesian Limestone, &c.
	3. Carboniférien	Coal-Measures.
	2. Devonien	Old Red Sandstone.
	1. Silurien { Supérieur	Upper Silurian.
	1. Silurien { Inférieur	Lower Silurian.

STRATIFIED ROCKS OF NORTH AMERICA.

(*After Marcou and Bigsby*, 1859.)

Stages.	*Sections.*	*British Equivalents.*
UPPER.	Peat-Mosses and Savannahs. River Alluvia and Deltas.	POST-TERTIARY.
LOWER.	Superficial Gravels and Raised Beaches.	
UPPER.	Boulder Formation of the Northern States and Canada.	TERTIARY.
MIDDLE.	Clays and Sands of North Carolina, &c. Greensand and Marls of Maryland, &c.	
LOWER.	Limestones and Clays of the Carolinas, &c.	
	Yellow Limestone and Greensand of New Jersey, &c.	CRETACEOUS.
	Sandstones, Shale, and Coal of Richmond, Virginia.	OOLITIC (?)
UPPER.	Red Sandstones of Connecticut, Mass. &c.	TRIASSIC (?)
LOWER.	Do. of Chatham, N. Carolina, &c.	PERMIAN (?)
UPPER.	Coal-formation or Coal-measures.	CARBONIFEROUS.
MIDDLE.	Lower Carboniferous Limestone.	
LOWER.	Sandstones and Conglomerates of Pennsylvania. Gypsum, Marls, and Conglomerates of Nova Scotia.	
UPPER.	Old Red Sandstone.	DEVONIAN.
MIDDLE.	Chemung Rocks; Portage Sandstone; Genessee Slate; Tully Limestone; Hamilton Rocks; Marcellus Shales.	
LOWER.	Carboniferous Limestone; Onondago Limestone; Schoharie Grit; Caudi-galli Grit; Oriskany Limestone.	
UPPER.	Upper Pentamerus Limestone; Delthyris shaly Limestone; Lower Pentamerus Limestone; Waterlime Rocks; Onondago Salt Rock; Coralline Limestone, Schoharie; Niagara Shale and Limestone.	SILURIAN.
MIDDLE.	Clinton Rocks; Medina Sandstone; Oneida Conglomerate.	
LOWER.	Hudson-River Rocks; Utica Slate; Trenton Limestone; Birdseye Limestone; Chazy Limestone; Calciferous Sandstone; Potsdam Sandstone.	
	Huronian Sandstones and Schists	CAMBRIAN.

PALÆOZOIC ROCKS OF PENNSYLVANIA.

(*After Professor H. D. Rogers*, 1859.)

	Appalachian Series.	*New York Names.*	*British Equivalents, nearest.*
UPPER.	Seral,	,,	CARBONIFEROUS.
	Umbral,	,,	
	Vespertine,	,,	
MIDDLE.	Ponent,	Catskill Group.	DEVONIAN.
	Vergent,	Chemung Group.	
	Cadent,	Hamilton Group.	
	Post-Meridian,	Upper Helderberg Limestone.	
	Meridian,	Oriskany Sandstone.	
	Pre-Meridian,	Lower Helderberg Limestone.	SILURIAN.
	Scalent,	Niagara Group.	
	Surgent,	Clinton Group.	
	Levant,	Medina Group.	
LOWER	Matinal	Hudson and Trenton Riv. Gr.	CAMBRIAN.
	Auroral,	Blue River, Chazy, and Calciferous Sandstone Groups.	
	Primal,	Potsdam Sandstone.	

"These fifteen formations, or *series* of deposits," says Professor Rogers, "defined by their prevalent organic remains, and by the physical horizons which separate them as sediments, are called by names significant of their relative ages—the words employed suggesting metaphorically the different periods of the day. Thus, beginning with the lowest or earliest, they mean respectively Dawn, Daybreak, Morning, Sunrise, Mounting-day, Climbing-day, Forenoon, Noon, Afternoon, Declining-day, Descending-day, Sunset, Evening, Dusk, and Nightfall. Some such nomenclature, *based on time*, is, for many reasons, preferable to the inexpressive ones which rest for the most part on geographical terms, only locally correct, or on narrow and inconstant palæontological characters."

CONTEMPORARY OR EQUIVALENT DEPOSITS.

I. POST-TERTIARY SYSTEM.

	British.	*Foreign.*
HISTORICAL.	Peat of Great Britain and Ireland, with human remains, &c. Fens, marshes, and river-deposits, with ancient canoes, implements, &c. Lake-silts, fresh-water marls, &c., with canoes, metal implements, remains of domesticated animals, &c. Accumulations of sand-drift, shore-caves, and beach-deposits, considerably beyond the reach of existing tides.	Terrain quaternaire of French authors, in part.—Modern portion of Deltas of Rhine, Nile, Ganges, Mississippi, &c.—Marine strata enclosing temple of Serapis at Puzzuoli. — Fresh-water strata enclosing temple in Cashmere.—Tundras of Siberia; Tarai or Jungle soil of India; Cypress swamps, &c. of America.—Modern part of coral-reefs of Red Sea and Pacific.—Travertine of Italy; calcareous tufa of Guadaloupe; and Lavas of Vesuvius and Etna, overspreading objects of human art, &c.
PREHISTORICAL.	Peat-moss, Lake-silts, and other alluvia, with tree-canoes and rude stone implements. Alluvia and river-deposits, with remains of Irish-deer, wild oxen, mammoth, and other extinct mammals. Cave-deposits in part, with bones of extinct mammals, stone implements, and fragments of charred wood.	Terrain quaternaire of French authors in part. — Upper Alluvia of Tigris and Euphrates.—River-silt of Upper Egypt in part.—Upper portion of cave-deposits of Mediterranean and Southern Europe, with stone implements and charred wood.—Plain of Holland in part; and much of the river-alluvia of America.

	British.	*Foreign.*
POST-GLACIAL.	Shell-marl under peat, and submarine forests of modern trees. Raised beaches at various heights, with species of shells more boreal than those of existing seas. Ancient alluvia and gravel of most of our carses, straths, dales, and holmes — the "Brick Clay" of many authors. Contains remains of seals, whales, &c.; and of extinct land mammals, as mammoth, rhinoceros, urus, &c. Cave-deposits in part, with bones of extinct and living carnivora and herbivora — ursus, hyæna, megaceros, rhinoceros, hippopotamus, &c. No human remains.	Loess of the Rhine, with recent fresh-water shells and mammoth bones.—Volcanic tufa of Ischia, with living species of marine shells, and without human remains or works of art.—Newer boulder formation in Sweden.—Bluffs of the Mississippi. — Driftwood and mammoth-gravel of the Arctic seas.—Tchornozem or black-earth of the Aralo-Caspian plain.—Auriferous Drift, in part, of the Uralian, Australian, and Californian gold-fields.

II. TERTIARY SYSTEM.

PLEISTOCENE or NEWER PLIOCENE.	Glacial drift or boulder formation of Norfolk, of the Clyde, of North Wales —the "Boulder Clay" of many authors. — Norwich Crag.—Cave-deposits of Kirkdale, &c., with bones of extinct and living quadrupeds.	Terrain quaternaire, diluvium. Terrain tertiare supérieur. —Glacial drift of Northern Europe; of Northern United States; and Alpine erratics. —Limestone of Girgenti Kunkur of India (?); Australian cave-breccias.
OLDER PLIOCENE.	Red Crag of Suffolk, Coralline Crag of Suffolk.	Sub-Apennine strata.—Hills of Rome, Monte Mario, &c.—Antwerp and Normandy Crag.—Aralo-Caucasian deposits, older part.—Pampas Formation of South America, &c.
MIOCENE.	Marine strata of this age wanting in the British Isles.—Leaf-bed of Mull. Lignite of Antrim (?)	Falurien supérieur. — Faluns of Touraine.—Part of Bordeaux beds. — Bolderberg strata in Belgium.—Part of Vienna Basin.—Part of Mollasse in Switzerland.—Sands of James River and Richmond, Virginia. — Greensands and marls of Maryland, United States.

	British.	*Foreign.*
UPPER EOCENE (*Lower Miocene of many Authors.*)	Hempstead beds near Yarmouth, Isle of Wight.	Lower part of Terrain tertiare moyen.—Calcaire Lacustre supérieur, and grès de Fontainebleau.—Part of the Lacustrine strata of Auvergne.—Limburg beds, Belgium.—(Rupelian and Tongrian system of Dumont). Mayence Basin. Part of brown coal of Germany.—Hermsdorf tile-clay, near Berlin.
MIDDLE EOCENE.	1. Bembridge or Binsted Beds, Isle of Wight. 2. Osborne or St Helens series. 3. Headon Series. 4. Headon Hill sands and Barton clay. 5. Bagshot and Bracklesham Beds. 6. Wanting (?)	1. Gypseous series of Montmartre, and Calcaire lacustre supérieur. 2 and 3. Calcaire silicieux. 2 and 3. Grès de Beauchamp, or sables moyens.—Laecken beds, Belgium. 4 and 5. Upper and Middle Calcaire grossier. 5. Bruxillien or Brussels Beds of Dumont. 5. Lower Calcaire grossier, or glauconie grossière. 5. Caiborne beds, Alabama. 5 and 6. Nummulitic formation of Europe, Asia, &c. 6. Soissonnais Sands, or Lits Coquilliers.
LOWER EOCENE.	1. London Clay and Bognor Beds. 2. Plastic and mottled clays and sands; Woolwich Beds. 3. Thanet Sands.	1. Wanting in Paris Basin, occurs at Cassel in French Flanders.—Limestones and Clays of the Carolinas (?) 2. Argile Plastique et Lignite. 3. Lower Landenian of Belgium, in part.

III. CRETACEOUS SYSTEM.

MAESTRICHT BEDS.	Wanting in England.	Danien of d'Orbigny. Calcaire pisolitique, Paris. Maestricht Beds. Coralline limestone of Faxoe in Denmark.
UPPER WHITE CHALK.	White Chalk, with flints.	Senonien of d'Orbigny. Obere Kreide and Upper Quader-sandstein of the Germans. La Scaglia of the Italians. Yellow Limestone and Greensand of New Jersey, in part.

	British.	*Foreign.*
Lower White Chalk.	Chalk without flints. Chalk Marl.	Turonian of d'Orbigny. Calcaire à hippurites, Pyrenées. Upper Pläner Kalk of Saxony. Yellow Limestone and Greensand of New Jersey, in part.
Upper Greensand.	Loose sand, with bright green grains. Forestone of Merstham, in Surrey. Marly stone, with chert, Isle of Wight.	Cénomanen of d'Orbigny. Gres Vert Supérieur. Craie Chloritée. Lower Quadersandstein of the Germans.
Gault.	Dark-blue Marl, Kent. Folkestone Marl. Black Down Beds (sandstone and chert), Devonshire.	Albien of d'Orbigny. Glauconie Crayeuse. Lower Pläner Kalk of Saxony.
Lower. Greensand.	Greensand of Kent and Sussex. Limestone (Kentish Rag). Sands and Clay, with calcareous concretions and chert, Atherfield, Isle of Wight. Speeton Clay, Yorkshire.	Gres Vert inférieur. Neocomien supérieur. Aptien of d'Orbigny. Hils Conglomerat of Germany. Hils-thon of Brunswick.
Wealden.	Clay, with occasional bands of limestone and sandstone; Weald of Kent, Surrey, and Sussex. Sand, with calcareous grit and clay; Hastings, Cuckfield, Sussex.	Neocomien Inférieur. Formation Waldienne. Wälderformation of North Germany.

IV. OOLITIC OR JURASSIC SYSTEM.

Upper Oolite.	1. Purbeck Beds. 2. Portland Stone and Sand. 3. Kimmeridge Clay.	1. Serpuliten Kalk and Walderformation of N. Germany, in part.—2. Portlandien of d'Orbigny.—3. Kimmeridgien of d'Orbigny. —Calcaire à gryphées virgules, of Thirria.—Argiles de Honfleur of de Beaumont.
Middle Oolite.	1. Calcareous Grit. 2. Coral Rag. 3. Oxford Clay. 4. Kelloway Rock.	1 and 2. Corallien of Beudant and d'Orbigny.—Calcaire à Nerinnées of Thurmann.—3. Oxfordien Supérieur.—4. Oxfordien Inférieur or Callovien of d'Orbigny.

GEOLOGICAL SCHEME.

	British.	Foreign.
LOWER OOLITE.	1. Cornbrash and Forest Marble. 2. Great (or Bath) Oolite and Stonesfield Slates. 3. Fuller's Earth, Bath. 4. Calcareous Freestone and Yellow Sands (Inferior Oolite).	1 and 2. Bathonien; Grand Oolithe; Calcaire de Caen. 3 and 4. Oolithe inférieur; Oolithe ferrugineux of Normandy; Oolithe de Bayeux; Bajocien of d'Orbigny.
LIAS.	1. Upper Lias. 2. Marlstone. 3. Lower Lias.	1. Toarcien of d'Orbigny. 2. Lias Moyen; Liasien of d'Orbigny. 3. Calcaire à gryphée arquée; Sinemurien of d'Orbigny; Coal-field of Richmond, Virginia (?); and Coal-fields of India (?)

V. TRIASSIC SYSTEM.

UPPER.	Bone-bed of Axmouth; Saliferous and Gypseous Shales and Sandstones of Cheshire.	Saliferien of d'Orbigny; Marnes irisées of the French; Keuper of the Germans.
MIDDLE.	Wanting in England.	Conchylien of d'Orbigny, in part; Calcaire à Cératites of Cordier; Muschelkalk of Germany.
LOWER.	Red and White Sandstones and Quartzose Conglomerates of Lancashire and Cheshire.	Bunter Sandstein of the Germans; Grès bigarré of the French; Conchylien of d'Orbigny, in part; Red Sandstones of Connecticut, U.S.

VI. PERMIAN SYSTEM.

MAGNESIAN LIMESTONE.	1. Laminated and Concretionary Limestones of York and Durham. 2. Brecciated Limestone do. 3. Fossiliferous Limestone. 4. Compact Limestone, do. 5. Marl-slate of Durham.	1. Stinkstein of Thuringia. 2. Rauchwackè do. 3. Dolomit or Upper Zechstein. 4. Zechstein proper. 5. Mergel or Kupfer schiefer.
RED SANDSTONE.	Red Sandstones, Grits, and Marls; Dolomitic Conglomerate of Bristol, Exeter, Annandale, &c.	Rothliegendes of Thuringia. Permian of Russia. Grès des Vosges of French. Red Sandstones of Chatham, North Carolina, U.S.

VII. CARBONIFEROUS SYSTEM.

	British.	*Foreign.*
UPPER.	1. Upper or True Coal-Measures.	1. Coal-fields of the United States.
MIDDLE.	1. Millstone Grit of England. 2. Mountain or Carboniferous Limestone.	2. Calcaire Carbonifère of the French.—Bergkalk or Kohlenkalk of the Germans.—Pentremite Limestone, U.S.
LOWER.	1. Lower Coal-measures and "Calciferous Sandstones" of Scotland.—Lower Limestone, Shale, Mendips. — Carboniferous Slates of Ireland.	1. Kiesel Schiefer and Jüngere Grauwackè of the Germans. Gypseous Beds and Encrinital Limestones of Nova Scotia.—Cypridina Schiefer of Nassau, Saxony, &c.

VIII. DEVONIAN OR OLD RED SANDSTONE.

UPPER.	1. Yellow Sandstones of Dura Den, Fifeshire.—White Sandstones of Elgin (? Triassic). 2. White and chocolate-coloured Sandstones and Grits of Berwick and Roxburgh.	1. Upper Devonians of Russia; Cypridina Schiefer of Germany, in part. 2. Catskill Group, U.S.
MIDDLE.	1. Red Sandstones and Marls of Perth, Forfar, Hereford, &c. 2. Upper and Middle Schists and Limestones of Devonshire. 3. Micaceous and Bituminous Flags of Caithness. 4. Great Pebbly Conglomerate of Scotland.	1. Eifel Limestone; and Upper and Middle Devonians of Russia, in part. 2 and 3. Middle Devonians of Russia, in part; Chemung, Genessee, and Hamilton Groups, North America.
LOWER.	1. Lower Devonian of North Devon. 2. Grey Flagstones of Perth and Forfar; Tilestones of Hereford, in part.	1. Spirifer Sandstone and Slate. 2. Russian Devonian, lower part; and Onondago and Oriskany Groups, North America.

IX. SILURIAN SYSTEM.

UPPER.	1. Upper Ludlow Rocks; Lesmahago Tilestones. 2. Aymestry Limestone. 3. Lower Ludlow. 4. Wenlock Limestone and Shale. 5. Llandovery Rocks.	1-5. Upper stages of Bohemian Basin; E to H of Barrande. 1-3. Pentamerus, Delthyris, and Onondago Groups, New York.—4. Schoharie Coralline Limestone.—5. Medina Sandstone.

	British.	Foreign.
LOWER.	1. Caradoc Sandstone. 2. Bala Beds. 3. Llandeilo and Lingula Flags. 4. Longmynd or "Bottom Rocks."	1 and 3. Lower stages of Bohemian Basin; C and D Barrande. — 4. Primordial zone of Barrande; Slates of Angers, France.—1-4. From Oneida Conglomerates to Potsdam Sandstone inclusive.

X. CAMBRIAN SYSTEM.

UPPER.	Fossiliferous Schists of Wicklow; Schists and Slates of North Wales.	Alum Schists of Sweden; lowest fossiliferous rocks of Wisconsin and Minnesota.
LOWER.	Lower Grits and Schists of Dumfries; and Grits, Schists, and Conglomerates of Northern Highlands.	Huronian Sandstones and Chloritic and Gneissose Schists.

II.

GENERAL TERMS AND TECHNICALITIES

GENERAL TERMS AND TECHNICALITIES.

A — ABR

A.—In words derived from the Greek, the prefix *a* is used privatively, or in a negative sense, and has the effect of the English word *without,* as *a-podous,* without feet; *a-cephalous,* without a head; *a-cotyledonous,* having no seed-lobes; and *a-zoic,* destitute of organic remains.

Abdômen (Lat. *abdo,* I conceal).—In animals the belly or cavity containing the viscera; **Abdominal**, pertaining to the belly.

Abdominâles (Lat. *abdo,* I conceal; hence *abdomen,* the belly).—In the zoological arrangement of Cuvier a section of the *Malacopterygian,* or soft-finned fishes, which have their ventral fins placed on the abdomen, behind the pectorals. The section includes the carps, the silures, the salmons, the herrings, and the pikes.

Abérrant (Lat. *ab,* and *erro,* I wander from).—Applied in Natural History classification to those species ("aberrant species") which differ widely from the type of the natural group or family to which they belong, or rather under which they are usually arranged.

Abietítes (Lat. *abies,* the fir-tree).—A genus of coniferæ occurring in the Wealden and Lower Greensand. The genus has been founded chiefly on the fossil cones which are often found in great perfection—these cones being composed of scales that terminate in a point, and not in a rhomboidal disc as in *Pinus,* which see.

Abnórmal (Lat. *ab,* from, and *norma,* a rule).—Without rule or order; irregular; in a condition differing from that produced in the regular course of nature; deviating from the general type or form; not occurring in the usual order, or according to that which is generally considered as the natural law.

Abranchiâta (Gr. *a,* without, and *branchia,* gills).—Applied to animals which have no apparent external organs of respiration, as the leech, earthworm, &c., and which respire by the entire surface of the skin, or by internal cavities. The *Abranchiata* constitute the third order of the Annelida of Cuvier. The term *Abranchia* has also been applied to certain amphibia, as the *menopoma* and *amphiuma,* which do not undergo meta-

morphosis, but breathe by lungs during the whole of their existence.—See BRANCHIA and its compounds.

Abrâsion (Lat. *ab*, from, and *rasus*, rubbed or scraped).—The operation of wearing away by rubbing or friction. Currents of water laden with sand, shingle, and other rock-debris are the chief abrading agents in nature. Abrasion may also result from the passage of icebergs, the descent of glaciers, &c.; hence the frequency of abraded rock-surfaces in connection with the "Boulder clay." *Abrasion*, as a geological result, presents some important distinctions as compared with *Denudation* and *Degradation*, which see.

A'brazite.—One of the Zeolite family, known also as *zeagonite* and *gismondine*. Its crystals occur in hemispherical bundles in the cavities of volcanic rocks; are of a greyish-white to a reddish-brown or red colour; and consist essentially of silica, alumina, lime, and potash.

Absôrbent (Lat. *ab*, and *sorbeo*, I suck in).—Capable of sucking in fluids; in Geology, applied to soils, rocks, and minerals which have the quality of readily imbibing water into their pores and interstices.

Abstérgent (Lat. *abstergo*, I cleanse).—Having a cleansing property; fullers' earth is an abstergent.

Acaléphæ (Gr. *akaléphe*, a nettle).—A zoological term for the soft gelatinous radiata known as medusæ, sea-nettles, jelly-fish, &c. The term has reference to the property which many of them possess, of causing, when touched, a hot stinging sensation like that produced by the nettle.

Acânthoteûthis (Gr. *acántha*, a thorn, and *teuthis*, a cuttle-fish).—A genus of fossil cuttle-fishes occurring in oolitic strata, and so termed from the horny hooklets that arm their tentacles, which appear to have been ten in number. These hooklets, the horny sucking-discs, and internal bones or osselets (belemnites), are generally the only portions preserved.

Acânthodes (Gr. *acantha*, a spine or thorn).—One of Agassiz's genera of ganoid fishes occurring in the Upper Devonian and Lower coal-measures, and characterised by its strong thorn-like ichthyodorulites or fin-spines. The type of the family *Acanthodidæ*, in which all the fins are furnished with strong spinous rays—the dorsal and anal being single.

Acanthopterýgian (Gr. *acantha*, a spine or prickle, and *pterygion*, a winglet or fin).—A term applied to fishes having the back or dorsal fin composed of spiny rays, as the perch, gurnard, &c. One of Cuvier's orders of osseous fishes.

Acânticone (Gr. *acantha*, a prickle).—An all but obsolete synonyme for pistacite, a sub-species of prismatic augite spar or epidote, which see.

Acâridæ or Acarea (Lat. *acărus*, a mite).—The mite family (so called from the typical genus *acarus*), to which the mite, the tick, the water-mite, and other minute arachnidans belong. They are chiefly of geological interest from the experiments of Crosse, who imagined he could produce some species (*acarus Crossei*, &c.) at will, by passing long-continued currents of electricity through certain siliceous solutions.

Accipensérida (Lat. *accipenser*, the sturgeon).—The sturgeon family, a well-known but limited group of ganoid fishes belonging to the sub-order Chondrostea or Loricata, and especially characterised by the almost total absence of an osseous vertebral column, and by the presence, in most species, of a strong dermal covering or exo-skeleton consisting of large bony tuberculated plates arranged in rows on the upper surface of the body, and shielding the head as if in solid piece. The existing sturgeons

are chiefly of large size, and inhabit the sea, but ascend the larger rivers for the purpose of spawning: the fossil species seem to have been governed by a similar habit, and are found from the lower Tertiaries upwards.

Accípitres (Lat. *accipiter*, a hawk; from *accipere*, to seize).—The ornithological term for the rapacious birds, such as the eagles, falcons, hawks, &c., which seize their prey with their talons. There are two subdivisions, the diurnal and the nocturnal. Their remains occur, though very sparingly, from the lower Tertiaries upwards.

Acclímatise (Fr. *acclimater*).—To accustom a plant or animal to a climate not natural to it; to accustom to the temperature of a new climate. Plants and animals may, within certain limits, become acclimatised, and flourish and increase in a new country, though not indigenous to it.

Accrétion (Lat. *accretio*).—Increase by external addition of new matter; applied strictly to mineral or inorganic increase. Plants and animals grow by alimentation, or the *assimilation* of additional matter; minerals enlarge by *accretion*.

—— **Aceous.**—Terminations in *áceous* denote resemblance to, or partaking of the qualities of, a substance, as *argillaceous*, less or more clayey; *carbonaceous*, partaking of the qualities or appearance of carbon.

Acéphalous (Gr. *a*, without, and *kephalè*, the head).—Applied to those mollusca which, like the oyster and scallop, have no distinct head, in contradistinction from the *Encephalous*, or those with a distinct head. The division *Acephala* comprehends most of the bivalve molluscs, and several that are destitute of shells;—in other words, the *brachiopoda*, *conchifera*, and *tunicata*.

Acéscent (Lat. *acesco*, to become sour).—Slightly acid; applied to substances which, like vegetable and animal juices, become sour spontaneously; that is, on exposure to the oxygen of the atmosphere.

Acetabulífera (Lat. *acetabŭlum*, a sucker, and *fero*, I bear).—Literally "sucker-bearers;" that section of the cephalopodous molluscs whose arms or tentacles are furnished with rows of little cups or suckers, a characteristic peculiar to Neozoic genera.

Acetábulum (Lat. a sucker).—Applied to such organs as the cup-like sucking-discs (*acetabula*) with which the arms of the cuttle-fish are provided. So far as yet known, the arms of the Palæozoic cephalopods were void of sucking-discs—organs abundantly common to Mesozoic and Neozoic genera.

Achmite (Gr. *acmè*, a sharp point).—One of the hornblende family occurring in the granites and syenites of Norway in long greenish-black prismatic crystals, which terminate very acutely; hence the name. It consists of 55.6 silica, 32 iron peroxide, and 12.4 soda.

A'chroite (Gr. *a*, without, and *chroa*, colour). — A term employed by Hermann to designate the colourless varieties of tourmaline, as distinguished from the dark-coloured varieties (*Schorl*), and from the red (*Rubellite*).

Acícular (Lat. *acicula*, a little needle).—Mineral crystals occurring in slender, needle-like prisms or prickles as actynolite, are said to be *acicular*. Irregular aggregations of these slender prisms constitute the "acicular texture" of actynolite-rock and actynolite-slate.

Acículite (Lat. *acicula*, a needle).—Needle ore; a plumbo-cupreous sulphuret of bismuth occurring imbedded in quartz in long, thin, steel-

grey crystals, strongly marked with vertical striæ, and apparently in four or six-sided prisms. It consists of 35.8 lead, 11 copper, 36.7 bismuth, and 16.5 sulphur, and usually accompanies native gold.

Acidâspis (Gr. *akis,* spear-point, and *aspis,* buckler).—A genus of trilobites, so named by Murchison from the central lobe of the head-plate or cephalic shield projecting over the body in the form of a pointed stomacher.

Acídulous and Acidulated.—Slightly acid or sub-acid. Applied to certain waters and springs that hold in solution a small per-centage of sulphuric or other acid.

Acinóse (Lat. *acinus,* a seed or germ).—Granulated; applied to mineral textures and surfaces which have a granulated appearance like the fruit of the raspberry.

Acotylédonous (Gr. *a,* without, and *cotўledon,* seed-lobe).—Plants whose embryos have no seed-lobes or seminal leaves are so termed, in contradistinction to *Monocotyledons* and *Dicotyledons.*—See tabulations, "Vegetable Scheme."

A'crita (Gr. *akrĭtos,* indistinct).—In some zoological classifications, a primary division of the animal kingdom, comprising the lowest classes of radiata which are characterised by an *indistinct,* diffused, or molecular condition of the nervous system.—The Acrita constitute the *Protozoa,* the *Cryptoneura,* the *Oozoa,* and *Globular zoophytes* of other systematists.

A'crodont (Gr. *akros,* the summit, and *odous,* tooth).—A term applied by Professor Owen to those squamate or loricated saurians whose teeth are anchylosed to the summit of the alveolar ridge.—See THECODONT.

A'crodus (Gr. *akros,* the ridge, and *odous,* tooth).—Literally "ridge-tooth;" a genus of Cestraciont fish-teeth occurring abundantly in the oolitic and chalk formations, and characterised by their enamelled surface being covered with fine grooves and striæ which diverge from a central longitudinal ridge. They are known to collectors as *fossil leeches,* from a fancied resemblance to a contracted leech.

Acrôgenous (Gr. *akros,* the top, and *ginomai,* I am formed).—Applied to those cryptogamic plants which increase by growth at the summit, or "growing point," as the tree-ferns. Acrogens are therefore separated as a great botanical division from Thallogens, Endogens, and Exogens.—See tabulations, "Vegetable Scheme."

Acrognâthus (Gr. *akros,* high, and *gnathus,* the jaw).—Literally "deep-jaw;" a genus of fishes from the Lower Chalk, and arranged by Agassiz under the *Salmonidæ,* or Salmon-family.

Acrosâurus (Gr. *akros,* the point or summit, and *saurus,* lizard).—One of the extraordinary fossil reptiles discovered by Mr Bain in the supposed Triassic sandstones of South Africa. It has thirty or forty teeth on the alveolar ridge (hence the name), and a broad process of the cheekbone extending downwards over the side of the lower jaw.

Actínia (Gr. *aktin,* a ray).—The sea-anemone; so called from the ray-like arrangement of its tentacles, which surround the mouth like the petals of a flower. The *Actiniæ* belong to the class *Polypi,* or true polypes, and from their structure are sometimes named "Fleshy Polypes." It has been suggested by Dr Mantell that some of the minute siliceous spicules so abundant in Chalk, and commonly ascribed to sponges, may have belonged to Actiniæ, in whose structure such organisms also occur.

Actinocrínus, Actinócrinite (Gr. *actin,* a ray or thorn).—A genus of

encrinites found chiefly in the Carboniferous limestone, and distinguished by the thorn-like side-arms which project from the main column or stalk at irregular distances.—See ENCRINITE.

Actýnolite, Actinóte (Gr. *aktin*, a ray or thorn, and *lithos*, stone).—A mineral and rock of the granitic group, composed of radiating or thorn-like crystals of a dark or greenish hue, and in composition closely allied to hornblende.—Actynolite-rock and actynolite-slate are the common forms in which the mineral appears—the latter consisting of a basis of felspar with intermingled crystals of actynolite. According to Bonsdorf, specimens from Taberg consist of 59.75 silica, 21.10 magnesia, 14.25 lime, 3.95 protoxide of iron, with traces of manganese and fluoric acid.

A'damant (Gr. *adamas, adamantos*, unsubdued, strong).—An old term given to several minerals having the property of excessive hardness, as to the diamond. *Adamantine* and *adamantean*, hard as adamant; excessively hard; having the lustre of diamond.

Adamántine Spar.—The diamond spar of Werner; a variety of corundum occurring in rough crystals, with very distinct cleavage, hair-brown colour, and adamantine lustre.

A'dapis (Gr. *a*, not, and *dapis*, a carpet).—Literally "no-carpet;" a name given in allusion to its rough or prickly skin. An extinct Tertiary pachyderm, somewhat resembling a hedgehog, but three times the size of that animal. It seems, according to Cuvier, to have formed a link connecting the *Pachyderms* with the *Insectivora*.

Adhésion (Lat. *ad*, and *hæro*, to stick together).—The force of cohesion acting between solid masses which come in contact at many points; the more intimate the contact the greater the force.

Adiantítes.—A genus of fossil ferns found in the Coal-measures, and so termed from their resemblance to the existing *adiantum* or maiden-hair. (Gr. *adiantos*, of a *dry nature;* membranaceous).

Adípocere (Lat. *adeps*, fat, and *cera*, wax).—A light, waxy, fatty substance into which animal muscle is converted when buried in moist earth, or when subjected to long immersion in water. It is occasionally found in graveyards, in peat-bogs, and other similar situations; and is frequently cast up in lumps on the shores of tidal estuaries.

Adipócerite, or **Adipocere mineral.**—A fatty unctuous matter found in certain peat-mosses (the "creeshy clods" of the Scotch peat-digger); in connection with ironstone of the Coal-measures, as at Merthyr; and with sandstone strata, as at Binny in Linlithgowshire.

Adit (Lat. *adĭtus*, an approach or entrance).—An underground horizontal gallery or tunnel, generally opening from the lower level of a ravine or hillside into a mine for the purpose of carrying off its waters, or for the purposes of entrance, and removal of the ores.

Aduléria (Gr. *adularos*, sweetly-fair, in allusion to its soft lustre).—A transparent or translucent variety of felspar, known also as *ice-spar*, with splendent lustre, and either colourless and white, or slightly tinged with grey, green, or yellowish-brown. Specimens with a bluish opalescence are termed *moonstones*.

Æ'chmodus (Gr. *æchmê*, a point, and *odous*, tooth).—A genus of ganoid fishes belonging to the Lepidoid family, and so named from their small, sharp-pointed teeth. They are almost exclusively confined to the Lias formation, and are readily distinguished by their deeply oval contour—their bodies being about as deep as long, and covered with transversely

arranged four-cornered oblong scales. Formerly ranked under the genus *tetragonolepis*, or "four-cornered scale."

Æpyórnis, Æpiórnis (Gr. *aipus*, immense, and *ornis*, bird).—An extinct cursorial bird of gigantic dimensions, the eggs and a few scattered bones of which have been recently discovered in the alluvial deposits of Madagascar. The egg has six times the capacity of that of the ostrich; but judging from the large size of the egg of the New Zealand *Apteryx*, Professor Owen does not believe that the *Æpiornis* exceeded, if indeed it equalled, the *Dinornis* in stature. The bones would seem to indicate a bird at least double the size of the ostrich; and from their recentness, it appears not improbable that the creature may still be in existence in the interior of the island, which is almost unknown to Europeans.

Aeriform (Lat. *aër*, the air, and *forma*).—Air-like; applied to gaseous fluids, from their resemblance to common air; hence we hear of solid, liquid, and aëriform bodies.

Ærúgo (Lat. *æs, æris*, copper).—Literally copper-rust; verdigris; a sub-acetate of copper formed by the action of weak acids on its surface.

Æstuary or **Estuary**, which see.

Æthiops (Gr. *aitho*, I burn, and *ops*, the eye or countenance).—Applied to various chemical compounds in allusion to their black appearance, resembling that of the Ethiop. Thus we have *Æthiops mineral*, the black sulphuret of mercury; *Æthiops per se*, the grey oxide of mercury, &c.

Ætítes or **Ætites Lapis** (Gr. *ætos*, an eagle).—A variety of nodular iron-ore, said to derive its name from a popular notion that it was found in eagles' nests, where it was supposed to prevent the eggs from becoming rotten.—See Eagle-Stone.

Aerolite (Gr. *aër*, air, and *lithos*, stone).—Literally air-stone; a meteoric stone or mineral mass, which falls through the air, emitting light in its passage as if red hot, generally accompanied with a hissing or crackling sound, and occasionally with a report like thunder. Aerolites are by no means uncommon; and according to Schrœbers, the greater number of them have always the same general form, which is that of an oblique or slanting pyramid; and they are also alike in external appearance, presenting to view a black shining crust, as if the body had been coated with pitch. This crust or film is extremely thin, and is of the same composition with the mass, which, when broken, displays a semi-metallic ash-grey colour. So like are they to one another in colour and in external appearance, that Berzelius remarks, "We might believe them to have been struck out of one piece." In composition they are also remarkable for containing *malleable metallic iron*, *nickel*, and *chrome*, metals which, in a native state, are rarely if ever found in terrestrial substances. Besides these ingredients, they contain upwards of a dozen others (silica, magnesia, potash, cobalt, &c.); and their specific gravities range from 3.35 to 4.28. These common characteristics seem to indicate a common origin, and many ingenious arguments have been advanced to prove that they are not of terrestrial production. This is not the place to enter upon such speculations, but we may indicate briefly the leading hypotheses that have been advanced to account for the origin of these extraordinary bodies, which cannot in the mean time be associated with any known terrestrial minerals. It has been supposed—1st, That they are ejected from terrestrial volcanoes; 2d, That they are produced in the atmosphere, being formed from the gases exhaled from the earth; 3d, That they are thrown from lunar volcanoes;

and 4th, That they are celestial bodies, revolving either about the earth or the sun, in the manner of planets.—See METEORITE.

After-Damp.—Another name for "choke-damp," or carbonic acid, as occurring in coal mines *after* an explosion of "fire-damp," or light carburetted hydrogen.

Affinity (Lat. *affinis*, neighbouring, bordering on, related to).—A term frequently, but often very loosely, used by writers on natural history. "Affinity," as first defined by Macleay in contradistinction from "analogy," signifies the relationship which one animal bears to another in its structure, and is the closer as the similarity of structure is greater. Swainson illustrates this idea by comparing a goatsucker with a swallow and with a bat: with the one its relation is *intimate*, with the other *remote;* the goatsucker has affinity with the swallow, inasmuch as the structural organisation of the one bird is intimately related to the other; but it has only "analogy" to the bat, inasmuch as bird and mammal, though differing in structure, have the common function of feeding in the same manner on insects, and flying at the same hour of the day.—See ANALOGY and HOMOLOGY.

Agalmátolite (Gr. *agalma*, an image, and *lithos*, stone).—A variety of steatite or talc-mica; so called from its being carved into images and other figures.—See FIGURE-STONE.

Agáric Mineral (Lat. *agaricus*, a species of fungus).—A soft variety of carbonate of lime found in clefts and on other surfaces of rocks, in light and loosely-cohering incrustations. It is so light as almost to swim on water, and obtains its name from its resemblance to a fungus in texture and colour.

Agate (said to be from the river *Achates* in Sicily, where fine varieties occur).—A mixed, siliceous, semi-pellucid mineral usually found in veins, in nodules, and in geodes within igneous rocks. The geodes often consist of alternating bands or deposits of carnelian, calcedony, jasper, opal, quartz, &c.; hence the varieties of the mineral are known by such names as ribbon-agate, fortification agate, brecciated agate, moss agate, and the like. When cut and polished, the ribbon-agates exhibit the calcedony, jasper, quartz, &c. in parallel stripes; the fortification agates show the alternating bands in zigzag arrangements like the plan of a modern fortification; the brecciated consist of irregular fragments of the two former imbedded in a matrix of amethyst; and the moss-agates exhibit minute dendritic ramifications resembling fragments of moss, confervæ, &c., hence their respective names. The finer varieties of agate are termed *oriental;* the Arabian moss-agates are known to the jeweller as *mocha-stones;* and the most beautiful British varieties, being found in the traps of Scotland, are termed *Scotch pebbles.*

Agglomerate.—A term employed by Sir Charles Lyell to designate those accumulations of *angular* fragments of rock which are thrown up by volcanic eruptions, and showered to greater or less distances around the cone or crater of eruption. When they are carried to a distance by running water, and get worn and rounded, they become *conglomerates.*

Agnóstus (Gr. *agnostos*, unknown, obscure).—A genus of minute trilobites supposed to be characteristic of, and peculiar to, the lowest silurian zones. Little, however, is known of them either as to their zoological characteristics or geological distribution.

Aíguille (Fr.)—A needle; applied in physical geography and geology to the sharp serrated peaks of lofty mountains. It is generally the crystalline rocks, such as gneiss, quartz, and the like, which weather into the *aiguille* or needle-top.

Air-course.—In coal-mining, a general name for the air-traversing workings where ventilation is going on. The fresh air descending into the mine is termed the "*intake;*" and that which ascends after having passed through the workings is the "*return.*"

Aix.—A town in Provence, situated in the lowest part of a deep valley, the immediate flanks of which are composed of a thick fresh-water Tertiary formation, consisting of greyish-white calcareous marls, calcareo-siliceous grits, and beds of gypsum; the whole being a perfect storehouse of fossil fishes, plants, and insects.

A'kumite Series (Gr. *akŭmos*, tranquil).—According to Dr Fleming (*Lithology of Edinburgh*), the modern epoch, from the commencement of the Boulder-clay upwards, may be divided into three series, viz.—the *Taragmite*, the *Akumite*, and the *Phanerite.* The first embraces the Boulder-drift, or period of *disturbance;* the second, those laminated clays and sands which immediately overlie the Boulder-clay, and seem to indicate the assorting power of water under circumstances of comparative *tranquillity;* and the third, all those more superficial deposits whose modes and causes of formation are sufficiently *evident.*—See MODERN or POST-TERTIARY EPOCH.

Alabándine.—Sulphuret of manganese or hexahedral glance-blende. It occurs crystalline, but usually massive, granular, and disseminated, of an iron-black colour and semi-metallic lustre. It is found in veins with foliated tellurium, blende, and quartz, in Saxony, Mexico, and Brazil; and consists of 63.6 manganese, and 36.4 sulphur.

Alabáster (Gr. *alabastron*).—There are two well-known varieties of this marble-like mineral—the gypseous and the calcareous. The former is a semi-transparent, granular-crystalline variety of gypsum, or *sulphate* of lime, of various colours, but most esteemed when of a pure snow-white, and usually compact enough to stand the turning-lathe; the latter is a *carbonate* of lime, usually white or yellowish-white, and found as a stalactite or stalagmite. Alabaster is a mineral of common occurrence in secondary and tertiary formations (Cheshire, Montmartre near Paris, Volterra in Tuscany, &c.); and being soft and readily turned by the lathe, is manufactured into statuettes, vases, and other domestic ornaments; hence, perhaps, the term *alabastron*, an ink or perfume vase. Others derive it from *Alabastron*, a town in Egypt famous for the manufacture of such vases.

Albite (Lat. *alba*, white).—A variety of felspar of a greyish-white or milky-white colour, composed of silex 70.5, alumina 19.5, soda 9.5, and traces of lime and manganese. It is also known as *Cleavlandite* and *soda felspar.*

Album Græcum.—The whitish hardened excrement of dogs, wolves, hyænas, and other carnivora partially feeding on bones. It consists of the earth-of-bones or lime, in combination with phosphoric acid. Dr Buckland (*Reliq. Diluv.*, &c.) detected the substance in a fossil state in ossiferous caverns, such as those of Kirkdale and Kent's Hole, which are therefore concluded to have been the dens of Tertiary carnivora. More recently, Dr Falconer has found it abundantly in the bone-caves near Palermo, and indicative of animals of greater size than any of the existing hyænas.

Alcýonite.—A general term for the spongiferous fossils so common in the Chalk formation. They are fossil *alcyonia*, and very frequently form the basis or organic nucleus round which flints have collected. It has also been surmised by Dr Mantell that some of the minute siliceous spicules so common in the chalk may have belonged to alcyonia.

Alethópteris (Gr. *alethos*, true; *pteris*, fern).—One of Sternberg's genera of fossil ferns, closely allied to *pecopteris*, and merged by Lindley into that genus. It abounds particularly in the lower coal-formation, but some of the species range up through the Oolite and Wealden.—See PECOPTERIS.

A'lgæ (Lat. *alga*, sea-weed).—Cellular aquatic plants, mostly of marine habitat. They are found fossil, less or more, in every formation from the silurian upwards; and are known by such terms as *fucites*, *chondrites*, *palæochorda*, &c., from their resemblance to the living *fucus*, *chondrus*, *chorda*, &c.

A'lkalies (Arabic, *al*, the, and *kali*, the name of a plant yielding the alkali).—In chemistry a class of bodies which possess a strong acrid and caustic taste; exercise a corrosive action upon all animal matter; turn vegetable blues *green*, and vegetable yellows *brown;* and which neutralise the acids by combining with them in definite proportions, and forming compounds called *salts*. The principal alkalies are potass, soda, and ammonia.

Alkaline Earths. — A term applied to *baryta*, *lime*, *magnesia*, and *strontia*, in consequence of their possessing alkaline properties, as causticity, action on vegetable colours, and the like.

Allanite.—A silico-aluminate of cerium, containing varying proportions of iron, lime, and magnesia. It is named after the late Mr Allan, of Edinburgh, and is closely allied to, if not identical with, the *cerin* and *orthite* of other mineralogists.

Alligátor.—The generic term for the crocodilians of the American continent, which have a broad, obtuse snout, and the canine teeth of the lower jaw received into a pit of the upper. Remains of closely allied forms have been found in the tertiaries of Europe; *e.g. A. Hantoniensis*, from the eocene beds of the Hampshire basin.

Allóchroite (Gr. *allos*, different, and *chroa*, colour).—A variety of iron-garnet, so called from the colours it exhibits when melted with phosphate of soda before the blowpipe.

Allophane (Gr. *allos*, different, and *phaino*, I appear).—One of the clay family, consisting essentially of silica, alumina, and water of crystallisation. It occurs in translucent, reniform masses, of a pale blue, white, green, or brown colour.

Allótropy, Allotrópic (Gr. *allotrŏpos*, turning otherwise, of a different nature).—A term employed by Berzelius to denote the fact that the same body may exist in more than one usual condition, and have different physical characteristics. Carbon is a good example of this condition, as it crystallises perfectly in the diamond, imperfectly in graphite, and is amorphous and quite distinct in anthracite and coal.

Allóy (Fr. *aloi*, mixture of one metal with another).—A natural or artificial compound of one or more metals; as *brass*, an admixture of copper and zinc; *bell-metal*, a compound of copper and tin, &c.

Allúvium, Alluvial (Lat. *luere*, to wash, and *ad*, together).—Matter washed or brought together by the ordinary operations of water is said to be *alluvial*, and the soil or land so formed is spoken of as *alluvium*. The soil of most of our river-plains (the "straths" and "carses" of Scotland, and the "dales" and "holmes" and "fens" of England) is chiefly of alluvial formation; these low grounds having once been the sites of lakes, estuaries, and shallow arms of the sea. All mud-deposits, as silt, warp, and the like, when converted into dry land, constitute alluvium.—See DILUVIUM.

A'lmandine.—A lapidary's term for the violet or violet-red varieties of

the spinel-ruby; for the noble garnet, which is also of a columbine red approaching to violet; and for the pyrope or "Elie ruby," which see.

Alstonite.—The *baryto-calcite* of Johnston, a carbonate of baryta and lime, so called from occurring at Alston Moor, in Cumberland.—See BARYTO-CALCITE.

Altaite.—Hexahedral tellurium; a metallic ore occurring massive in granular aggregates of a yellowish-white colour, and consisting of 60.35 lead, 1.28 silver, and 38.87 tellurium. It is found mixed with tellur-silver in the Sawodinski mine in the Altai mountains; hence the name.

Alum (Lat. *alumen*, Gr. *ἅλς*, *ἁλος*, salt).—Alum is a double salt, the sulphate of alumina and potash, the crystals of which contain nearly 50 per cent of water. Mineralogists mention several varieties, differing slightly in external and other characters, according as one isomorphic element is replaced by another, as *potash-alum* (34 sulphuric acid, 18 alumina, 10 potash, and 46 water), *soda-alum*, *ammonia-alum*, *magnesia-alum*, and *iron* or *feather alum*. The alum of commerce is chiefly manufactured from certain transition slates (Norway), from coal shales (Lanarkshire, &c.), lias-shales (Yorkshire), from lignite shales (Germany), and it occurs also in the volcanic formations of Sicily, &c.; hence the geological terms *alum-slate*, *alum-shale*, *aluminite*, *alum-stone*, &c. Rocks containing alum in notable proportion generally manifest its presence, when exposed to air and moisture, by emitting whitish or yellowish-white efflorescences of the salt; and these as well as the water which trickles from the rocks are readily detected by their strong styptic taste.

Alúmina.—The pure plastic principle of clay, which is usually a silicate of alumina. Alumina is, in fact, an oxide of the metal aluminium, consisting of aluminium 12 and oxygen 8. Alumina is rarely found in a pure state in nature, and occurs chiefly as the basis of the clays, boles, loams, and other argillaceous earths. In its pure crystallised state it constitutes the sapphire, corundum, and other of our hardest gems.

Alúminite.—The mineralogical term for the native hydrated sub-sulphate of alumina.

Alúminum, Alumínium, or Alúmium.—The metallic base of alumina; as *calcium* is the metallic base of lime, or *sodium* of soda. As a metal it is now being prepared to some extent, in France and England, from the *Cryolite* of Greenland; and from its lightness and brilliant white colour has been employed, though as yet with very indifferent success, as a substitute for silver.

A'lunite (Fr. *alun*, alum).—Alumstone; occurring in minute rhombohedral crystals, but very frequently in fine, granular, earthy, or compact masses, intimately mixed with quartz or felspar. It is found in Hungary, and in many parts of Italy—the *Roman alum*, valued on account of its purity, being chiefly obtained from this mineral by repeated roasting and lixiviation. "In volcanic regions," says Nicol, "it is often formed by the action of sulphurous vapours on trachyte, and in other felspar rocks by the decomposition of iron-pyrites."

Alúnogene (*alun*, alum, and *ginomai*, I produce). — A sulphate of alumina, known also as *hair-salt* or *feather-alum*. It occurs in fine capillary fibres forming crusts, and irregular botryoidal masses; has a silky lustre, yellowish-white colour; tastes like alum; and consists of 36.05 sulphuric acid, 15.40 alumina, and 48.55 water. It seems to be, for the most part, a product of chemical changes now in progress; often forms in

volcanic solfataras, or in clays, and felspar rocks containing pyrites; and is a frequent efflorescence on the walls of quarries and mines.

Alvéolus (Lat.)—A little trough or hollow channel; applied variously in natural history, as the *alveolus* or conical chamber of the belemnite; **alveolites**, a genus of corals composed of concentrically arranged tables of short tubes, externally angular, and rounded within.

Amálgam.—A compound of mercury with other metals is termed an *amalgam;* the union of any other metal with another an *alloy.* Some derive the term from the Greek *ama* together, and *gameo* I wed; others with more probability from *malagma* a poultice or paste (from *malasso,* I soften), in reference to the pasty nature of the admixture. A native amalgam (of 36 silver and 64 mercury) occurs in the mines of Sweden, Hungary, Spain, and South America, in fine silver-white plates, crusts, and arborescent forms; and in America, under the name of *arguerite,* is worked as an ore of silver.

Amalgamation.—The process of making an *amalgam* of mercury with some other metal, for the purpose of separating the silver and gold they may contain. This operation is founded on the property which mercury possesses of dissolving these metals out of the minerals with which they are associated.

Amazon-Stone.—A variety of common felspar coloured green by the oxide of copper, and so named from its occurring in rolled masses near the river Amazon.—See AXE-STONE.

Amber (Arabic).—A well-known fossil gum or gum-resin, usually found in connection with tertiary lignites. It is hard, rather brittle, easily cut, of various shades of yellow, and semi-transparent. It is very light, is highly electric, and burns, like other hydro-carbons, with much smoke and flame. It consists of about 70 carbon, 12 hydrogen, and 8 oxygen; and frequently encloses chips of leaves, insects, and the like—showing that it must once have been in the state of a gummy or viscous exudation. It occurs in irregular nodules, from the size of a hazel-nut to that of a man's head, the latter size, however, being very rare. It is found in Sicily, Poland, Saxony, Siberia, and Greenland, in tertiary clays; on the Yorkshire coast of our own country; but in particular on the Baltic coast of East Prussia, where it is thrown up after storms, and strewn like pebbles along the shore. It is also, but very seldom, obtained by digging down to the looser beds of the tertiary lignites in Northern Germany; and there it appears in connection with coniferous trunks and branches. These forests of Amber Pines (*Pinus succinifer*) seem to have been situated in the south-eastern part of what is now the bed of the Baltic (about 55° N. Lat., and 37° to 38° E. Long.), and were probably destroyed at the commencement of the Drift period.

Ambergris (Fr. *Grey-amber,* in allusion to its amber-like character).—An odorous, solid substance, supposed by some to be a morbid secretion from the liver or intestines of the spermaceti whale, analogous to the biliary calculi; and by others, to be merely the indurated fœces of the animal, perhaps somewhat altered by disease. It is usually found floating or cast on shore, in irregular lumps. No analogous fossil substance is yet known to geologists.

Amblýpterus (Gr. *amblys,* blunt, and *pterus,* fin).—Literally "blunt or broad fin;" a genus of ganoid fishes belonging to the *Lepidoid* family, occurring in the carboniferous formation, and characterised, as the name

implies, by their very large and wide fins, composed of numerous rays. Scales rhomboidal and highly enamelled ; tail boldly heterocerque.

Amblyúrus (Gr. *amblys*, blunt, and *oura*, a tail).—Literally "blunt or broad tail ;" a genus of Lepidoid fishes, found fossil in the Lias formation, and so named from the full development of the caudal fin.

A'methyst.—Quartz or rock-crystal, coloured by a minute portion of iron and manganese. The amethyst is a transparent gem of a purple or violet-blue colour ; it is sometimes naturally colourless, and may at any time be deprived of its colour by the action of heat. Some derive the name from its colour, which resembles wine mixed with water ; while others think it obtained its name (Gr. *a*, priv., and *methystes*, drunkard), from its supposed virtue of preventing intoxication, and hence worn by topers as an amulet.

Amethýstine.—Possessing the properties of an amethyst ; having that violet-blue tinge or colour peculiar to the amethyst, as "Amethystine Quartz."

Amiánthus (Gr. *a*, priv., and *miaino*, to soil).—This term, though often used as synonymous with *asbestos*, properly includes only the varieties which occur in delicate and regular silky fibres. The name is said to be derived from the incombustible nature of the mineral, which, when woven into cloth, admits of being cleansed by being thrown into the fire. That small fancy fabrics can be manufactured of amianthus is well known : it was occasionally so employed by the ancients, and is still used for that purpose in Siberia, Italy, and the Pyrenees. It is also employed as incombustible lamp-wicks ; for filling gas-grates—the fibres remaining red-hot without being consumed ; and attempts have been made to manufacture it into an incombustible paper. Amianthus is found abundantly in many countries, particularly in primitive districts ; and occurs in veins in which the filaments or fibres are perpendicular to the surfaces of the vein, and of various lengths, according to the thickness of the vein, which is sometimes, though rarely, a foot. Like the Hornblendes, to which it belongs, it consists chiefly of silica (58), magnesia (25), lime (12), with traces of alumina, iron, manganese, and water.—See ASBESTOS.

Ammónia.—A transparent pungent gas, formed by the union of nitrogen and hydrogen, and named from *sal-ammoniac* (muriate of ammonia), of which it forms the basis. Ammonia is of geological interest, as being one of the products given off by active volcanoes.—See SAL-AMMONIAC.

A'mmonite.—The fossil shell of a numerous and varied genus of cephalopodous mollusca, coiled in a plane spiral, and chambered within like the existing nautilus ; so called from the resemblance of the shell to the horns on the statue of Jupiter Ammon. "Cornu Ammonis," "Whitby snakes," and "snakestones," are obsolete synonymes.—See AMMONITIDÆ. In the ammonites proper, the shell is discoidal ; inner whorls more or less concealed ; septa undulated ; sutures lobed and foliated ; siphuncle dorsal. The range of the genus is from the Trias to the Chalk inclusive ; and already upwards of 500 species have been described. These have been arranged by palæontologists (Von Buch and D'Orbigny) into *six* sections, according as the back of the shell is keeled, crenated, sharp, channeled, squared, or round and convex ; and these sections have been again divided into *fifteen* groups, according to form, armature, sutures, or other peculiarity. They are as follows :—

1. *Arietes.*	
2. *Falciferi.*	Back keeled.
3. *Cristati.*	
4. *Amalthei.*	Back crenated.
5. *Rhothomagensis.*	
6. *Disci.*	Back sharp.
7. *Dentati.*	Back channeled.
8. *Armati.*	
9. *Capricorni.*	Back squared.
10. *Ornati.*	
11. *Heterophylli.*	
12. *Ligati.*	
13. *Annulati.*	Back round, convex.
14. *Coronati.*	
15. *Fimbriati.*	

Figures of these types or groups are given on the Palæontological Map of the British Islands in *Johnston's Physical Atlas.*

Ammonítidæ.—A numerous extinct family of tetrabranchiate cephalopods, of which the well-known ammonite is the type. The family ranges from the Devonian to the Chalk inclusive, becoming extremely abundant and varied in form in the upper secondary formations. It includes the *goniatites, bactrites, ceratites, ammonites* proper, *criocerites, toxocerites, ancylocerites, scaphites, heliocerites, turrilites, hamites, ptychocerites,* and *baculites,* which see. In the Ammonitidæ the shell is external and many-chambered; body-chamber elongated; aperture guarded by processes, and closed by an operculum; sutures angulated, lobed, or foliated; siphuncle external (or dorsal as regards the shell). The shell has essentially the same structure as that of the nautilus—a porcellanous layer externally, and a nacreous lining internally. In some species of ammonite the shell is armed with prominent spines or tubercles; and in others the outer margin is furnished with curious projecting processes. The Ammonitidæ, in one or other of their genera, are perhaps the most remarkable of Secondary mollusca. See CEPHALOPODA.

Amórphous (Gr. *a*, without, and *morphê*, form).—Applied in geology and mineralogy to rock-masses and minerals that have no regular or determinate structure, in contradistinction from those which, like basalt and rock-crystal, always appear in some definite form. Void of structure; massive.

Amorphozóa (Gr. *a*, without; *morphê*, form; and *zoon*, an animal).—The lowest class of the animal kingdom, containing the sponges and their allies; so called from their want of regular symmetrical structure. Fossil remains of this class occur in notable abundance in the Chalk Formation.

A'mpelite (Gr. *ampelos*, the vine).—A term used by Brogniart for alum-slate, which occurs both in the metamorphic and fossiliferous series.

Amphi.—A Greek prepositional prefix signifying about, on both sides, near to, or concerning; and frequently used to imply doubt as to which of two sides, or to which of two things, the object in question belongs; as *amphibious,* capable of living either in the water or on land.

Amphíbolé and Amphibolite.—The names usually given by French geologists to *Hornblende* and *Hornblende Rock,* which see. The terms are derived from the Greek *amphibolos,* ambiguous or equivocal, in allusion to the difficulty of distinguishing hornblende from augite, which is similarly constituted.

Amphícyon (Gr. *amphi,* implying doubt, and *kŭon,* dog).—A large car-

nivorous quadruped, found principally in miocene tertiaries, and so termed from its intermediate position between the digitigrade and plantigrade families, as indicated by its tuberculated molars or carnassial teeth.

A'mphigens (Gr. *amphi,* all around, and *ginomai,* I am formed).—Plants which increase by the growth or development of their cellular tissue on all sides, as the Lichens.—See tabulations, "Vegetable Scheme."

Amphiléstes (Gr. *amphi,* implying doubt, and *lestes,* beast of prey).—A small quadruped of doubtful relationship, only the lower jaw of which has yet been found in the Stonesfield oolite, Oxfordshire. From the structure of its teeth—the molars having three cusps, the large middle one of which has two small accessory tubercles or cuspules—it is supposed to be an insectivorous marsupial, allied perhaps to *amphitherium.*

Amphistegína (Gr. *amphi,* on both sides, and *stegê,* a roof).—A genus of foraminiferous shells, occurring abundantly in the tertiary basin of Vienna, and so termed from the flatly conical or roof-like aspect both of its upper and under surface. According to d'Archiac it takes the same place among the foraminifera of the Miocene era which the nummulites occupy in the Eocene period.

Amphithérium (Gr. *amphi,* implying doubt, and *therion,* wild beast).—An insectivorous mammal of the oolitic epoch, whose teeth and jawbones have been found in the Stonesfield slate of Oxfordshire. The doubt that hangs over the true affinities of these remains (whether marsupial or placental) has necessitated the provisional name of *amphitherium.*

Amýgdaloid (Gr. *amygdălon,* an almond, and *eidos,* appearance).—This term is applied to certain igneous rocks containing small almond-shaped vesicular cavities, either partially or entirely filled with agate, jasper, calc-spar, and other minerals. These minerals being of a different colour from the mass of the rock in which they are imbedded, look like almonds in a cake; hence the terms *amygdaloid* and *amygdaloidal.* The amygdaloids—as "amygdaloidal trap-tuff," "amygdaloidal wackè," &c.—are especially abundant in the Trap series, and many of them seem to have originally been open vesicular lavas, through which waters charged with siliceous and calcareous solutions had percolated for ages, until, finally filling up the cavities with the agates, calc-spars, &c. already alluded to, they became the amygdaloids in question.

A'nalcime (Gr. *a,* without, and *alkimos,* strong).—A zeolitic mineral found abundantly in trappean rocks, and so named by Haüy on account of its feebly electric properties. A specimen from Kilpatrick Hills consisted (according to Connel) of silica 55.07, alumina 22.23, soda 13.71, potash and lime a trace, and water 8.22.

A'nalogue (Gr. *ana,* with, and *logos,* reasoning).—An object that has a resemblance to, or correspondence with, another. "Analogue" has reference to *similarity of function;* "homologue" to *identity of parts.* Thus, the wing of a bird and the dermal expansion of a bat are analogues, because they each enable their respective possessors to fly or sustain themselves in the air; but the wing-bones of the bird and the arm-bones of the quadruped are homologues, being anatomically identical. *Analogue* and *homologue* (which see), and *analogous* and *homologous,* are contradistinguishing terms.

Análogy (Gr. *ana,* with, and *logos,* reasoning).—That relationship, resemblance, or correspondence which one object bears to another in functional duty or performance. For the precise differences between *analogy, affinity,* and *homology,* see these terms.

Ananchýtes.—A genus or subdivision of fossil sea-urchins belonging to the tribe *Spatangidæ*, and especially characteristic of the upper chalk-formation. They are readily distinguished by their elevated helmet-like form, by their simple ambulacra converging towards the summit, and by the transverse mouth and oblong outlet situated on the inferior face of the flat base, and towards the margin. Known in the south of England as "shepherd's crowns," and "fairy-loaves."—See SPATANGIDÆ.

A'natase (Gr. *anatasis*, stretching forth).—Another name for *pyramidal titanium ore*, or *octædrite*, which is all but a pure oxide of titanium. Anatase is remarkable for its electrical properties; occurs in the granitic and crystalline rocks; of a dark indigo blue, hyacinth red, or yellowish-brown colour; and in elongated pyramidal crystals—hence the name.

Ancylóceras (Gr. *anculos*, incurved, and *keras*, horn).—A genus of the Ammonitidæ peculiar to the oolite and chalk, and so named from the singular shape of the shell, which is at first discoidal, with separate whorls, afterwards produced at a tangent, and bent back again like a hook or crosier.

Andalúsite.—One of the garnet family, found chiefly imbedded in mica-schist, or in druses in other crystalline rocks, and so called from its being first discovered in Andalusia. It occurs for the most part in large prismatic crystals; is always coloured, grey to green, flesh or peach-blossom red, violet blue or reddish brown; and consists of 40 silica and 60 alumina, with traces of iron, manganese, and lime.

A'ndesite.—The name given by Gustavus Rose to a trachyte of the Andes, which contains the felspar called *Andesin*, together with glassy felspar (orthoclase) and hornblende disseminated through a dark-coloured base.

Anemómeter (Gr. *anemos*, the wind, and *metron*, a measure).—An instrument for measuring the force and velocity of the wind, which see.

A'neroid (Gr.)—Literally without fluid. In the *aneroid barometer* the pressure of the atmosphere is measured by the elevation or depression of the surface of a closed metallic vessel exhausted of air. The pressure of the atmosphere being marked at a given time, any alteration is indicated by the movements of the surface, and communicated to wheels marking the change on a dial furnished with an index. Being easily carried about, the *aneroid* is extremely useful in enabling the geologist and traveller to approximate the height of mountains.

Angiospérms (Gr. *angeion*, a vessel, and *sperma*, seed).—Plants whose seeds are encased, or in seed-vessels, in contradistinction to *gymnosperms*.—See tabulations, "Vegetable Scheme."

Anhýdrite (Gr. *a*, without, and *hydor*, water).—A transparent gypsum or sulphate of lime occurring in a crystalline form without water of crystallisation. Anhydrite occurs chiefly with rock-salt and gypsum, or in the clays associated with these deposits. The fine crystalline varieties are known as *muriacite*—the granular as *vulpinite;* and all are much harder and heavier than ordinary gypsum.

Anhýdrous (Gr. *a*, without, and *hydor*, water).—Without water; applied to minerals which do not contain water as an ingredient. Without water of crystallisation.

Animálcules (Lat. diminutive of animal).—A general term in zoology for exceedingly minute animals which cannot be studied without the assistance of the microscope.

Annéaling.—The process by which glass and porcelain are rendered less brittle, and by which the metals become tougher and more malleable. It is performed by placing the materials to be operated on in furnaces or ovens heated to a certain temperature, and then allowing them to cool gradually and slowly. During the process the molecular arrangement of the material undergoes a change analogous to what takes place in lava, which forms granular or glassy rocks according to the rapidity with which it is cooled—the quicker the process, the glassier and more brittle the product.

Annéllida (Lat. *annellus*, a little ring).—Annelids. One of the classes of the animal kingdom having their bodies formed of a great number of small rings like the earth-worm, a double-ganglionated nervous cord, and red blood. They have been variously subdivided; but that arrangement which ranks them as *Errantia*, walking or swimming annelids, like the *nereis; Tubicola*, those which inhabit solid tubes, like the *serpula; Terricola*, those burrowing in the earth, as the earth-worm (*lumbricus*); and *Suctoria*, those furnished with a sucking cavity at each end, like the leech (*hirudo*), is perhaps the most intelligible. The casts, and tracks, and burrow-holes of annelids occur in all formations, *arenicolites, scolites*, &c.

Annulária (Lat. *annulus*, a ring).—A genus of fossil herbaceous plants with verticillate foliage like *asterophyllites*, but having the whorls arranged on the same plane with the stems on which they grew. It is supposed that they were aquatic plants, and that the stems and leaves floated on the surface of the water.

Annulósa (Lat. *annulus*, a ring). — A designation given by Macleay to the *Articulata*, in allusion to their ringed or annulated bodies. The term in this sense is seldom employed by other zoologists.

A'nodon, Anodónta (Gr. *a*, priv., and *odous, odontos*, a tooth). —The swan mussel; a genus of the *Unionidæ* or river-mussels, deriving its name from the circumstance that its shell has no *teeth* or articular processes at the hinge. Recent and fossil.

Anomópteris (Gr. *anomos*, without rule, and *pteris*, fern). —Literally "anomalous fern," and so named because the plants differ from all recent and fossil ferns. In this genus, which is peculiar to the New Red Sandstone, the leaves are very large, and deeply pinnate; the leaflets long, linear, entire, and traversed by a distinct median rib; the secondary veins are simple, perpendicular to the mid-rib, and thickening towards their free extremities.

Anoplothérium (Gr. *a*, without, *oplon*, weapon, and *therion*, beast). — A genus of quadrupeds found in the Paris Tertiaries, and so called from being destitute of any organs of defence, as tusks, claws, or horns. The common anoplothere (*A. commune*) has been taken as the type of a small family—the ANOPLOTHERIDÆ, which seem to constitute a sort of transition from the pachyderms to the ruminants. There are several species, from the size of a hare to that of a dwarf ass; and from the situations in which they are found, they appear to have lived in herds, in swamps and marshes. In some the tail is long and thick, as if it had assisted the animal in swimming, in others it is short and taper; in all, the legs are slender, and the feet terminate in two large toes as in the ruminants, while their tarsal bones resemble those of the camel. Their dentition is peculiar —there being six incisors in each jaw, on each side of which was a small canine, and behind these (*without leaving any interval*) seven molars, resembling those of the rhinoceros. According to Cuvier, the anoplothere

stands in one respect between the rhinoceros and horse, and in another between the hippopotamus, hog, and camel.

Anórthite (Gr. *an*, without, and *orthos*, upright).—One of the felspar family; and so called (*without right angles*) to distinguish it from *orthoclase*, two of whose cleavages are at right angles to each other.

Anóura (Gr. *a*, without, and *oura*, tail).—Tailless; a class of the batrachian reptiles, including the frog, toad, &c., which are all *anourous*, or destitute of tails.—See tabulations, "Animal Scheme."

Antagonist Forces.—Two powers in nature, one counteracting the other, and preserving a general equilibrium on or within the earth's crust; *e.g.*, fire and water.

Antarctic (Gr. *ante*, opposite, and *arctic*).—Applied to the regions surrounding the South Pole, as being directly opposite to those of the Arctic or North Pole; hence we speak of the "Antarctic Circle," "Antarctic Seas," &c.

Anthophyllite (Gr. *anthos*, flower, and *phyllon*, a leaf).—A species of hornblende, of a clove-brown colour, occurring in radiating columnar aggregates, which resemble the *anthophyllus*, or clove.

Antholítes or Antholithes (Gr. *anthos*, flower, and *lithos*, stone).—The general term for the fossil inflorescence of plants, or rather the impress of their flowers. Such inflorescence occurs in the shales of the coal-measures, and more abundantly in tertiary strata. The affinities of the Palæozoic *antholites* are altogether undetermined; those of the Tertiary epoch seem related to the *Liliaceæ* and other existing orders.

A'nthracite (Gr. *anthrax*, carbon).—A species of coal almost wholly deprived of its bitumen. It may be regarded as a natural coke or charcoal, formed by subterranean or chemical heat. Ordinary bituminiferous coal is often found converted into a kind of coke by the contact of igneous rocks; and in this way some anthracites may have originated, though the majority seem to be the result of that slow change or *metamorphosis* which all rock-masses seem to undergo in the course of ages. As a mineral, anthracite occurs massive and amorphous (though portions have occasionally a slaty, columnar, or fibrous structure), has a sub-conchoidal fracture, less or more of a metallic lustre, of a greyish-black or iron-black colour, streak unaltered, conducts electricity perfectly, and burns open with a very weak or no flame. It varies greatly in composition, though good American sorts generally yield about 90 carbon, 3 hydrogen, 5 ashes, and the remainder oxygen and hydrogen. Submitted to the microscope, either in thin slices or in a state of ash, many varieties exhibit the vegetable structure, and leave no doubt as to the organic origin of all. Though not so convenient in an industrial point of view as ordinary coal, anthracite is gradually rising in importance for the manufacture of the metals, steam-raising, and even for household purposes—the United States at present consuming annually about five millions of tons. "It is very common" (Nicol's *Man. of Mineral.*) "in many parts of the English, Scottish, and Irish coal-fields. It forms whole beds in the Alps, as in the Valais, Piedmont, Savoy, and Dauphiné; in the Pyrenees; and in various parts of France. In Germany it occurs in Silesia, Bohemia, Saxony, and the Harz, but not in very large amount. It is especially abundant in the United States, as in Rhode Island, Massachusetts, and above all in Pennsylvania, where it seems to be an altered portion of the common bituminous coal of the Western States."—See COAL FAMILY.

Anthráconite (Gr. *anthrax*, coal). — A mineralogical term applied to those varieties of marble which, like the Kilkenny, have a coal-black lustre when polished. Most of the black marbles contain bitumen, and yield a sulphureo-bituminous odour when struck by the hammer.

Anthracothérium (Gr. *anthrax*, coal, and *therion* beast).—A fossil pachydermatous animal, first found in the tertiary lignites or wood-coals of Cadibona in Liguria; hence the name. So far as yet determined, the genus seems to stand intermediate between river-hog and hippopotamus. In the lignites of Savone, remains of carnivora, marsupialia, bats, birds, crocodiles, tortoises, and fish occur along with those of the anthracothere.

Anthrópolite (Gr. *anthropos*, man, and *lithos*, stone).—A petrifaction of the human body; a term which has been applied to the petrified human bones from Guadaloupe and other localities. These remains can scarcely be considered *fossil*, or even *sub-fossil;* but must be regarded in the same light as any recent petrifaction produced by the action of calcareous waters.

Anticlínal (Gr. *anti*, on opposite sides, and *clino*, I bend).—Applied to strata which dip in opposite directions from a common ridge or axis, like the roof of a house, and from what is termed an "anticline" or "saddle-back." *Syncline* and *synclinal* are the opposite terms, which see.

A'ntimony.—One of the metals, of a tin-white colour, with a greyish or yellowish tarnish; somewhat sectile, but so brittle as to be easily reduced to powder by trituration; fuses at 900, and has a specific gravity of 6.712. The most abundant ore is the sulphuret of antimony, occurring in veins in the older secondary and transition strata. The metal is used in medicine, but principally to form alloys with other metals, as *type-metal*, which is a compound of lead and antimony. The name is derived by some from the Greek words *anti* and *monos*, signifying that it is never found by itself, but in combination with other metals; and by others from *antimoine*, that is "anti-monk," in allusion to a ridiculous story told of Basil Valentine, its discoverer in 1620, who, observing that hogs fattened rapidly on receiving small doses of it, administered it to his fellow-monks, but unluckily in such proportions as to prove fatal to them; hence the term *anti-moine*.

Antípodes (Gr. *anti*, opposite, and *pous*, *podous*, foot).—Applied to those who dwell on opposite sides of the globe, as having their feet opposed to each other. Those in New Zealand, for example, are the antipodes of those in Britain.

Antiséptic (Gr. *anti*, opposed to, and *sepo*, I putrefy).—Substances which, like common salt and tannin, prevent putrefaction in animal and vegetable matter, are said to be antiseptics, or to possess antiseptic properties.

Apáteon (Gr. a cheat; deceptive).—The name originally proposed by Von Meyer for the then imperfect remains of the *archegosaurus;* because, so far as the fragments admitted of discrimination, "its head might be that of a fish, as well as that of a lizard, or of a batrachian." See ARCHEGOSAURUS.

Apatite (Gr. *apatè*, deceptive).—A genus of calcareous earths, composed of 55.75 lime, and 44.25 phosphoric acid; hence known as phosphates of lime. In most varieties hydro-chloric acid is also present, from a mere trace, up to 2.10 per cent. Apatites are of various colours, white, yellowish-white, greenish-white, brown, blue, &c., and occur both massive and crystallised. From their fracture, &c., they are spoken of as foliated, conchoidal, and massive—the massive having an uneven fracture, and

being generally known by the name of "*phosphorite.*" Apatite occurs in connection with metalliferous veins in the metamorphic and granitic rocks, and is found in Cumberland, Devon, and Cornwall; in Spain, Germany, Norway, and America. The phosphorites of Spain and Norway have recently acquired additional interest from the proposal to employ them in the preparation of phosphatic manures—a purpose to which the phosphatic nodules of the English greensand have been applied with eminent success. According to Daubeny, the phosphorite of Estramadura consists of 81.15 phosphate of lime, 14.00 fluoride of calcium, 3.15 peroxide of iron, 1.70 silica, and 0.2 per cent chlorine. There is also a *talc-apatite* or *magnesian-apatite,* found in the Ural Mountains, which is probably a decomposed apatite—the lime being replaced to the extent of from 6. to 8. per cent by magnesia. From their variety of colour, fracture, &c., the apatites are apt to be mistaken for other minerals; hence the designation *deceptive.*

A'phanite (Gr. *aphanes,* not discernible).—A compact homogeneous rock of the Trap family, breaking with a smooth surface like some basalts, and consisting of hornblende, quartz and felspar, in combination so intimate, that they are individually *undiscernible;* hence the name. It is known also as *cornean* (*cornu,* a horn), in allusion to its toughness and compact texture.

A'phrite (Gr. *aphros,* froth or foam).—Known also as *earth-foam* and *foam-spar.* A fine scaly variety of calcareous spar or carbonate of lime, having a shining pearly lustre and somewhat greasy feel. Found in veins and cavities in various formations.

Apiócrinite (Gr. *apion,* a pear, and *encrinite,* which see).—A sub-genus of encrinites, distinguished by their pear-shaped receptacle, and peculiar to the chalk and oolitic formations. In the Pear Encrinite the roots seem to have been confluent, the stem round and of moderate length, the digestive cavity pear-shaped, the arms rather short than slender. "When living," says Dr Buckland (*Bridgewater Treatise*), "their roots were confluent, and formed a thin pavement or crust over the bottom of the sea, from which their stems and branches rose into a thick submarine forest, composed of those beautiful zoophytes. Its stems and bodies are occasionally found united, as in their living state; the arms and fingers have almost always been separated; but their dislocated fragments still remain covering the pavement of roots that overspreads the surface of the subjacent oolitic limestone."

Apophýllite (Gr. *apophyllizo,* to strip off leaves).—One of the Zeolite family, known also as *ichthyophthalmite* or fish-eye-stone, and deriving its present name from its *leaf-like* texture, and ready *exfoliation* under the action of the blowpipe.

Apóphysis (Gr. springing from, of the same nature).—A process of a bone, and part of the same bone; and in this respect differing from *epiphysis,* which is a process attached to a bone, and not a part of the same bone.

A'pteryx (Gr. *a,* without, *pteryx,* a wing).—Literally "wingless;" a rare cursorial bird peculiar to New Zealand, and apparently approaching the verge of extinction. The existing apteryx, or "kiwi," of which there are two or three species, is little larger than a Guinea fowl; but an extinct species, the *palapteryx,* has been found in the ancient river-silts of New Zealand, rivalling in size the emeu and ostrich.

A'ptychus (Gr. *a,* without, and *ptychê,* fold).—A term applied by some

authors to the shelly or horny organisms better known as *trigonellites*, which see. The name *Aptychus* refers to the plates or valves being without fold or hinge.

Aquafórtis.—Literally *strong water ;* a familiar term for nitric acid, in allusion to its power of dissolving the metals.

Aqua Marine.—A lapidary's designation for the finest *beryls,* in allusion to the varying shades of "sea-green" which they usually present.

Aqua Régia.—Literally *royal water ;* a designation of the alchemists for *nitro-muriatic acid,* from its property of dissolving gold, the "king of the metals."

Aquátic (Lat. *aqua,* water).—Relating to the water ; having its habitat or usual position in water. Applied to plants which, like the water-lily, grow in water, and to animals which, like the diver and duck, live in or frequent the waters.

A'queous (Lat. *aqua,* water).—Watery ; pertaining to, or formed by, water. Usually applied to the *sedimentary* or *stratified* rocks, as having been formed by deposition from water, in contradistinction to the *unstratified,* or those arising from igneous fusion.

Araucarítes.—"This term," says Mantell, "is employed to designate the fossil wood whose structure is identical with that of the living Araucariæ, having the same kind of medullary rays, and the woody fibre, studded with discs or areolæ, which are polygonal, often hexagonal, and disposed in several alternating series." This wood is common in the Chalk, Wealden, Oolite, and Lias of Britain ; and trunks closely resembling the existing *A. excelsa* have been found in the Carboniferous formation, as at Craigleith and Granton, near Edinburgh, and also in Fifeshire. The *Araucariæ* are natives of the Southern Hemisphere, and are all more or less gigantic trees, growing from 150 to 200 feet in height, and often from 20 to 30 feet in circumference. It is an interesting fact, therefore, to find that trees closely resembling those of Australia and the adjacent islands, should at one period have flourished extensively in the northern latitudes now occupied by Great Britain.

Arborèscence (Lat. *arboresco*).—Literally growing like a tree ; applied to those *dendritic* or tree-like forms of crystallisation often observable in mineral productions.

A'rcanite (Lat. *arcanus,* hidden, concealed).—Sulphate of potash, occurring mostly in crusts and pulverulent coatings ; colourless or white ; having a saline, bitter taste, and soluble in water. It is found in volcanic lavas, and in solution in the water of some salt springs.

Archæocídaris (Gr. *archaios,* ancient, and *cidaris,* a turban, hence the "sea-egg," from its turban shape).—A genus of sea-urchins or cidaris, occurring in Carboniferous and Permian strata, and characterised by their small hexagonal plates, and long spines which in some species are smooth, in others notched and sharply denticulated.

Archæoníscus (Gr. *archaios,* ancient, and *oniscus,* woodlouse).—A genus of fossil Isopods (equal-footed crustaceans) occurring in the Purbeck or uppermost Oolitic strata, and so termed by the Rev. P. B. Brodie, from their close resemblance to the common woodlouse.

Archegosáurus (Gr. *archegos,* beginning, and *saurus,* lizard).—Literally "primeval lizard ;" a reptile of the Carboniferous era, having, according to Owen and Goldfuss, a near alliance to the *proteus, lepidosiren,* and other perennibranchiate reptiles of the present day.

A'rctic (Gr. *arctos*, a bear).—Relating to the North Pole or Polar Regions; in reference to the constellations of the Great and Little Bears which occur in the northern quarter of the heavens, and point, as it were, to the North Pole.—*Arctic Regions*, the high latitudes surrounding the North Pole; *Arctic Circle*, an imaginary line extending round the North Pole 62½° from the Equator, and parallel to it; hence certain parts are said to "lie within the Arctic Circle."

Arctic Current.—A well-known ocean current which originates in the polar regions of the north, and flows southwards towards the Equator. The main current seems to originate to the north of Spitzbergen, takes a westerly direction, and thence runs southward along the eastern shores of Greenland, till it meets with a minor branch flowing from Davis' Straits. The two then unite in one great current, which follows the Labrador coast, runs to the east of Newfoundland, and evidently loses itself in the "Gulf Stream;" or rather perhaps, from its greater density, passes in part under the Gulf Stream in latitudes 45°–47°, and holds on towards the Equator. It is to this current that we owe the phenomenon of icebergs in the Atlantic; and as these are frequently laden with boulders, gravel, and other miscellaneous debris, together with the remains of Arctic animals, there must be now forming along the bed of the North Atlantic a deposit analogous in many respects to the "Northern Drift" or "Boulder Clay" of a former epoch.

Arenáceous (Lat. *arēna*, sand).—Rocks composed of grains or particles of sand, or containing sand in any notable degree (as grits and sandstones), are said to be *arenaceous*. Compound rocks partaking of this quality are spoken of as *arenaceo-calcareous*, *arenaceo-argillaceous*, and so on, as their composition may indicate.

Arenicolítes.—A term applied to those circular holes or markings which appear in twos or twins on the upper surface of many sandstones, and which seem to have been worm-burrows like those of the *Arenicŏla* or lob-worm (*arena*, sand, and *colo*, I inhabit).

Argentíferous (Lat. *argentum*, silver, and *fero*, I bear).—Applied to veins, rocks, and other matrices containing the ores of silver, or silver in the native or metallic state.

Argentíte (Lat. *argentum*, silver).—Sulphuret of silver; an important ore of silver, occurring crystallised, also in crusts, or massive and disseminated; of a blackish lead-grey; feebly lustrous; malleable and flexible. It is found in the granitic, porphyritic, and crystalline rocks of many countries, and is one of the most important of the ores of silver. Consists of about 86.5 silver and 13.5 sulphur.

Argile Plastique.—Towards the base of the Tertiary System in France are extensive deposits of sands, with occasional beds of clay used for pottery purposes; hence the term *argile plastique*.—See TERTIARY SYSTEM.

Argilláceous (Lat. *argilla*, clay).—Applied to all rocks or substances composed of clay, or having a notable proportion of clay in their composition, as roofing-slate, shale, &c. Argillaceous rocks are readily distinguished by the peculiar odour they emit when breathed on, and known in mineralogy as the "argillaceous odour." Compound clayey substances are spoken of as *argillo-calcareous*, *argillo-arenaceous*, &c., as the case may be.

Argillíte (Lat. *argilla*, clay).—A mineralogical term for clay-slate; but very seldom used in geology.

A'rkose.—A name given by Brongniart to a compound of the same mate-

rials as granite, from which its materials have evidently been derived by disintegration. "It is found," says Lyell, "at the junction of granite with formations of different ages, and consists of crystals of felspar, quartz, and sometimes mica, which, after separation from their original matrix by disintegration, have been reunited by a siliceous or quartzose cement." In Sweden it immediately flanks the granite, and forms a coarse-grained sandstone or grit.

Arrágonite.—One of the calc-spar family, generally found in radiated and fibrous aggregates, in amygdaloidal cavities, and in fissures in basalt and basaltic tufas. It derives its name from Arragon in Spain, where it occurs in large macled crystals in gypsum. The coralloid varieties are usually known as *flos-ferri,* and the finely-fibrous and silky as *satin spar.* It differs from common calc-spar in containing from 1 to 3 per cent of strontia; but "is most readily distinguished from it by falling to pieces at a low temperature which does not affect the latter, and also by its prismatic cleavage."

A'rsenic (Gr. *arsenikon,* masculine).—The metal arsenic, so called from its possessing strong or powerful properties. Arsenic occurs chiefly in veins in the crystalline and transition strata, along with ores of antimony, silver, and lead; and the purest specimens usually contain traces of antimony, iron, silver, or gold. As an ore it is generally found in granular irregular masses or disseminated; is brittle; has a whitish lead-grey colour when newly broken, but soon tarnishes on exposure to the atmosphere, and becomes coated with a black sub-oxide of the metal. When struck or heated it gives off a strong garlicky smell known as the "arsenical odour;" and on being pulverised and moistened it undergoes spontaneous combustion. It has a strong tendency to combine with other metals, hence such natural compounds as *arsenic-silver, arsenic-antimony, arsenic-glance,* &c. Arsenic is used in various pharmaceutical preparations and in metallurgic processes, but is usually injurious when mixed with ores. The metal and all its compounds are violent poisons. The *white arsenic* of the shops is arsenious acid; *realgar* or red arsenic is the protosulphuret; *orpiment* or yellow arsenic is the sesquisulphuret, and constitutes the colouring matter of the pigment called *King's yellow;* and the well-known pigment *Scheele's mineral green* is an arsenite of copper. The metallic arsenic of commerce is chiefly obtained from arsenical iron pyrites or *mispickel,* which see.

Artésian Wells.—Wells sunk by boring perpendicularly through the solid strata, and in which the subterranean waters rise to the surface or nearly so—a method long known and practised in the province of Artois (the ancient Artesium) in France. Many of the Artesian wells in London and Paris are of great depth—that in the plain of Grenelle being about 1800 feet deep, bore 10 inches in diameter, discharge 517 gallons per minute, and temperature of water 82° Fahr. Artesian wells are generally situated in plains or in basin-shaped valleys, toward which the strata dip on one or more sides, and their principle depends upon the hydrostatic pressure of the water percolating through the inclined strata, and forcing its way upward by the artificial orifice to the highest level of the water-containing strata. The greater the depth the higher the temperature; and the lower the surface of the well compared with the outcrop of the water-yielding stratum, the higher will the *jet d'eau* rise above the orifice of the bore.

Articuláta (Lat. *articulus,* a joint).—One of Cuvier's great subdivisions

of the animal kingdom, comprehending all the invertebrata with jointed bodies, as insects, spiders, crustaceans, myriapods, and worms. See tabulations, "Animal Scheme."

Articulated (Lat. *articulus*, a joint).—Jointed; composed of parts united by joint-like processes. Occasionally applied in geology to the columns of basalt and greenstone, which, like those of the Giant's Causeway, are separable into blocks more or less regular, and thus seem jointed or articulated. Indeed, in some of the more perfect columns there is a regular ball-and-socket arrangement of the separable portions.

Arundináceous (Lat. *arundo*, a reed).—Resembling, or having the structure of, reeds. Arundinaceous (that is, striated and jointed) stems, are common in the coal-measures.

A'saphus (Gr. *asaphès*, obscure).—A genus of trilobites, so called from the obscurity which long rested on the true nature of these crustaceans. In this genus the carapace is wide and much depressed; the middle lobe distinct; the head-shield rounded in front, and terminating posteriorly in a sharp process on each side. The eye of the asaphus is compound, and contains several thousand lenses.

Asbéstus (Gr. *a*, priv., and *sbestos*, consumable or extinguishable).—Known also as *amianthus* and *byssolite*. Fine fibrous varieties of several of the hornblende family, as augite, tremolite, and actinolite, found chiefly in connection with serpentine. The fibres, often readily separable, elastic, and flexible, were used by the ancients in the manufacture of an incombustible cloth, hence the name *asbestos*, unconsumable. There are many varieties, and these receive their names from their appearance and quality —as *rock-wood*, *rock-cork*, *mountain-leather*, *fossil-paper*, *fossil-flax*, &c. In rock-wood the fibres are long, parallel, curved, and compact; in rock-cork they have a felted texture, and so light as to swim on water; in mountain-leather they form flat flexible pieces; and in fossil-flax they are so loose and silky that Dolomieu used it for packing his other minerals. Asbestus thus passes from the silky flexibility of amianthus to a degree of compactness which admits of receiving a fine polish.—See AMIANTHUS.

Ascídia or Ascidians (Gr. *askidium*, a little leathern bottle).—An order of the Tunicata or shell-less mollusca, so called from their resemblance to small leathern pouches. They are either social or solitary, and appear as pap-like gelatinous incrustations on rocks, dead shells, and other bodies.

A'sphalt (Gr. *asphaltos*).—This term is usually applied to a black, hard, brittle, and glossy variety of bitumen, which is distinguished from other varieties chiefly by its more difficult fusibility, and by its fracture being clean, conchoidal, and vitreous. It occurs in formations of all ages, and is associated with different kinds of rocks, though most frequently in connection with sandstones and limestones. The asphalt found floating on the Dead Sea (*Lacus Asphaltites*) was well known to the ancients; it was obtained from pits or springs near the Euphrates and Tigris, and used as mortar by the Babylonians; it is still largely found in Persia; it forms the principal feature of the "Pitch-lake" of Trinidad; an abundant commercial supply is obtained from Seyssel and other places near the Jura Mountains; and it occurs sparingly in rents and cavities in the carboniferous limestones of Britain.—See BITUMEN.

Aspidiária (Gr. *aspis*, *aspidos*, a shield). — A genus of lycopodian-like coal-measure stems, so called from the shape of their leaf-scars, which closely connect them with *lepidodendron*.

Aspidorhýnchus (Gr. *aspis, aspidos,* a shield, and *rhynchos,* a beak).—Literally "Buckler-beak;" a genus of sauroid fishes occurring in the Jurassic and upper secondary formations, and distinguished by the tapering or beak-like prolongation of their upper jaws, which were armed with numerous sharp-pointed conical teeth.

Aspleniópteris.—A fossil fern from the oolite and lias; so called from its resemblance to the existing *asplenium;* but regarded by Lindley as identical with PTEROPHYLLUM, which see.

Assáy (Fr. *essayer,* to try).—In mining and metallurgy, the determination of the quantity of gold or silver contained in ores, or alloys of these metals by cupellation. It differs from *chemical analysis* in merely furnishing the quantity of the precious metal contained in the sample examined, instead of the nature and proportion of all the ingredients.

Assimilation (Lat. *assimilo,* I liken to).—The process by which organised bodies convert aliment into the various tissues of their own proper substance. Plants and animals increase by *assimilation* and *transformation,* minerals by *attraction* and *aggregation.*

Astácolite (Gr. *astăcus,* the crayfish or lobster).—Applied to fossil or petrified crustaceans like the crayfish and lobster.

Asteracánthus (Gr. *aster,* star, and *acantha,* spine).—Literally "Starry-spine;" a genus of ichthyodorulites, so termed from having their surfaces richly ornamented with star-like tubercles. These fin-rays (often of large size) are common in the Lias, Oolite, and Wealden strata.

Astéria (Gr. *aster,* a star).—A variety of corundum or "star-sapphire," so called because, when cut *en cabochon* perpendicular to the axis of the prism, it shows a bright opalescent star of six rays corresponding to the other axes.

Astérialite (Gr. *aster,* star, and *lithos,* stone).—A term now rarely used for fossil or petrified *asterias,* or star-fish.

Aspidúra (Gr. *aspis,* a shield, and *oura,* tail).—A genus of star-fishes peculiar to the Muschelkalk of Germany. They are closely related to the existing *ophiura,* and are named from the buckler-like arrangement of the ossicles that protect the arms, which are four in number.

Astéridæ (Gr. *aster,* a star).—The Star-fish family, of which the common five-rayed star-fish (*asterias*), so abundant on our own coasts, has been taken as the type. Representatives of the family occur, according to E. Forbes, so early as Upper Silurian strata (*Uraster*); but this has been questioned by others, who would restrict the family to Mesozoic and Neozoic strata, in which such forms as *tropidaster, solaster,* and *goniaster* are unmistakable and abundant.

Asteróida (Gr. *aster,* a star, and *eidos,* resemblance).—An order of polypes, so called from the star-like or rayed arrangement of their tentacles when fully expanded. The asteroid polypes are all compound animals, inhabiting a polypidom, which consists of a fleshy external layer, supported upon an axis more or less calcareous and compact. The order embraces the *tubiporidæ,* or "organ-pipe corals;" the *alyconidæ,* or "dead men's fingers;" the *Gorgonidæ,* or "sea-fans;" and the *pennatulidæ,* or "sea-pens."

Astræidæ (Gr. *astræa,* from *aster,* a star).—The family of "star-corals," to whose stony calcareous secretions the formation of coral reefs is mainly owing. They differ from the *cyathophyllidæ* or "cup-corals," and from the *madreporidæ* or "tree-corals," not only in their forms, but in the

arrangement of their cell-rays, as well as in their mode of reproduction. The members of the family usually form thick stony masses; have the rays of the cells exceedingly numerous—the cells penetrating deeply into the mass of the coral; and most of them appear to increase by spontaneous division. The common *astræa* or "star-coral," and *meandrina* or "brain-coral," are familiar examples.

Asterólepis (Gr. *aster*, star, and *lepis*, scale).—Star-scale; a gigantic ganoid fish of the Old Red Sandstone, so named from the stellate markings on the dermal plates of the head, which are of great size, and form a strong expanded buckler, the orbits of the eyes being situated near the anterior border. The mouth of the asterolepis was furnished both with rows of small *fish*-teeth, and a thinly-set row of huge *reptile*-teeth. See Hugh Miller's work, *Footprints of the Creator, or the Asterolepis of Stromness.*

Asterophyllítes (Gr. *aster*, a star, and *phyllon*, a leaf).—An assemblage of plants found abundantly in the coal-measures, lias, and oolite; and so called from the star-like whorls of linear leaves (verticillate leaves) which surround the jointed stems, as in equisetum, hippuris, and the like. "The genus *asterophyllites* is so vague," says Lindley, "that it will comprehend any fine-leaved verticillate plants, the bases of whose leaves do not run into an annular rim." Beyond this, and the fact that they are dicotyledonous plants, botanists have not yet determined; so that many remains now classed under "asterophyllites" may in reality belong to very different families.

Astríngent (Lat. *ad*, to, and *stringo*, I draw tight).—Applied to those substances which, like the gall-nut, oak-bark, alum, &c., have the property of contracting or drawing together the muscular fibre; hence also such substances are spoken of as "astringents."

A'tacamite.—A native muriate of copper, so called from being found in the desert of Atacama, between Chili and Peru. It occurs in aggregates of small prismatic crystals, or massive with a granular structure. In the granular or arenaceous state it is known as "copper sand," and consists of 72 copper protoxide, 16 muriatic acid, and 12 water. It often appears on copper long exposed to the atmosphere or sea-water, and is the *ærugo nobilis* seen on antique bronzes.

Atmómeter (Gr. *atmos*, vapour, and *metron*, measure).—An instrument invented by Sir John Leslie for measuring the amount of evaporation from any moist surface in a given time.

Atmosphere (Gr. *atmos*, vapour, and *sphaira*, sphere).—The gaseous envelope or volume of air which surrounds the earth on every side, and which is either directly or indirectly the cause of numerous geological operations,—being the great laboratory in which all meteorological and electrical phenomena are elaborated, as winds, clouds, rains, snow, hail, and thunderstorms. As an air, it is composed of about 79 parts nitrogen and 21 oxygen, with variable traces of carbonic acid and other impurities. Calculating from its decreasing density, as well as from its diminished power of refracting light as we ascend from the earth, the height or extent of the atmosphere has been estimated at 45 miles; and the pressure of the whole volume on every square inch of the earth's surface (at the ordinary sea-level) at 14.6 lb. avoirdupois. This pressure is counterbalanced by a mercurial column of 30 inches in length; hence a column of 60 inches will be equal to two atmospheres; and it is customary to estimate the force of steam, of liquid lava, and other fluid pressures, by *atmospheres*—that is, in

round numbers, at the rate of 15 lb. per square inch for every atmosphere. As a *geological agent*, it is indispensable to the life of plants and animals, and any change in its normal composition would at once affect their existence. Increasing in density as we approach the earth, it becomes, as it were, the retainer and equable diffuser of the sun's rays. It is also the recipient and diffuser of all aqueous vapours arising from the earth; hence clouds, rains, snow, hail, &c. Its denser strata being heated in one region, they become lighter and ascend, and the colder and denser masses from other regions rush in to supply their place; hence aërial currents or winds; and hence also, from the contact and friction of its cloudy masses, the discharges of thunderstorms, and other electrical phenomena.

A'toll.—The name given to a coral island of an annular form—that is, consisting of a circular belt or strip of coral reef more or less continuous, with an enclosed lagoon.—See CORAL REEFS.

A'tom (Gr. *a*, priv., and *temno*, I cut).—In chemistry an ultimate particle of matter incapable of further division or reduction. In geology applied loosely to minute particles or molecules of solid matter.

A'trypa (Gr. *a*, without, and *trypa*, a foramen).—A genus of brachiopods closely related to *rhynconella*, and often mistaken for species of *terebratula*. They are rounded shells, not furrowed like *spirifer*, but ornamented with squamous lines of growth; the beak is small compared with terebratula, often closely incurved, and the foramen either concealed or very small and round (hence the name); hinge-line very short, and shell not punctured as in terebratula. About a dozen species are found, from the Lower Silurian to the Trias inclusive.

Attle.—A Cornish term for rubbish thrown out of a mine, containing little or no ore.

Attraction (Lat. *ad*, to, and *traho*, I draw).—Literally *a drawing towards;* a term denoting the mutual tendency of bodies towards one another—a power in nature which has been assumed as explanatory of many physical and chemical phenomena; hence such phrases as *Attraction of Cohesion, Attraction of Gravitation, Attraction of Affinity, Capillary Attraction, Magnetic Attraction,* and so forth.—See COHESION, GRAVITATION, CAPILLARY AND MAGNETIC.

Attrition (Lat. *attritus*, worn or rubbed down).—The act of wearing by friction or rubbing. In geology, the wearing and smoothing of rock-surfaces by the passage of water charged with sand and gravel, by the passage of sand-drift, the descent of glaciers, and the like.—See ABRASION.

Auchenáspis (Gr. *auchen*, the back part of the neck, and *aspis*, a buckler).—A provisional genus of Old Red Sandstone fishes, closely allied to, and in all likelihood identical with, *cephalaspis*, but separated by Sir P. Egerton in consequence of the appearance of a post-cephalic or neck-plate in a single specimen from the neighbourhood of Ludlow.

Aúgite (Gr. *augè*, lustre).—A mineral of the hornblende family, entering largely into the composition of many trap and volcanic rocks, as of basalt, greenstone, clinkstone, augite, porphyry, &c. In composition it is closely allied to hornblende proper, but differs in the form of crystal, contains less silica, is of greater specific gravity, and is also less fusible. Augite, known also as *Pyroxene*, has several varieties, which are distinguished by such names as *diopside, sahlite, malacolite, Baikalite, Fassaite, coccolite, Hedenbergite*, &c., which see. Augite, as it usually occurs, is of a greenish-black, pitch or velvet black, occasionally leek green, but rarely brown;

lustre vitreous to resinous; translucent or opaque; fracture conchoidal and uneven: crystallises in six or eight sided prisms, terminated by dihedral summits. Its constituents, taking the average of several analyses, are 53 silica, 19 lime, 15 magnesia, 6 iron protoxide, 2 manganese protoxide, and 5 alumina.

Augític.—Containing augite; resembling augite, as *Augitic Porphyry*, a rock with a dark-grey or greenish base, containing crystals of augite and Labrador felspar. *Augitic* traps are frequently spoken of in contradistinction to *felspathic* traps and claystones.

Auricle (Lat. *auricula*, a little ear).—In natural history any appendage or projection resembling ears; AURICLED, furnished with such appendages; AURICULATED, ear-shaped.

Auríferous (Lat. *aurum*, gold, and *fero*, I yield).—Yielding or containing gold; applied to rocks and veins containing the precious metal, as "auriferous veins," "auriferous sands," &c.

Aúriform (Lat. *auris*, the ear, and *forma*, shape).—Ear-shaped; having a form resembling the human ear, as the *haliotis* or ear shell, the *otopteris* or ear-fern, &c.

Auroral (Lat.)—Appertaining to the early morn; the second of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian Chain—the "Daybreak" of the N. American palæozoics, and the equivalent in part of our Middle Cambrians. See PALÆOZOIC FORMATIONS.

Autómalite (Gr. *automolos*, inconstant).—Octahedral corundum. A variety of corundum containing oxide of zinc, found crystallised (sometimes simple, sometimes as a macle) in talc schist, and associated with zinc-blende and galena. Its constituents, according to Abich, are 57.09 alumina, 34.80 zinc oxide, 4.55 iron oxide, 2.22 magnesia, 1.92 silica, and traces of manganese.

Auvergne.—A district in Central France celebrated for its extinct volcanoes, its fresh-water limestones, lacustrine formations, and other ancient alluvia. The subject of Mr Scrope's valuable monograph, *The Volcanoes of Central France.*

Avalánche (Fr. *avalange, lavange, lavanche*).—An accumulation of snow, or of snow and ice, which descends from precipitous mountains like the Alps into the valleys below. Avalanches originate in the higher regions of mountains, and begin to descend when the gravity of their mass becomes too great for the slope on which it rests, or when fresh weather destroys its adhesion to the surface. They are usually distinguished as Drift, Rolling, Sliding, and Glacial;—*Drift* are those caused by the action of the wind on the snow while loose and powdery; *rolling*, when a detached piece of snow rolls down the steep, licks up the snow over which it passes, and thus acquires bulk and impetus as it descends; *sliding*, when the mass loses its adhesion to the surface, and descends carrying everything before it unable to resist its pressure; and *glacial*, when masses of frozen snow and ice are loosened by the heat of summer and precipitated into the plains below.—See GLACIER.

Avánturine or Aventurine.—A variety of quartz deriving its peculiar play of colour from imbedded spangles of mica, or merely from the intersection of minute fissures. Also, a variety of felspar or *sunstone* (which see), whose play of colour, according to Scheerer, arises from minute imbedded crystals of iron-glance. "The name *Avanturine*," says Jackson

(*Minerals and their Uses*), "is said to be derived from the following circumstance:—A French workman having by accident, or *par aventure*, dropt some copper filings into a vitreous mixture in fusion, gave the name *Avanturine* to the sparkling mass which was thus produced; and it is still by a similar process, though greatly improved, that the artificial production is now manufactured, to be employed for various ornamental purposes. The artificial far exceeds in brilliancy the natural avanturine. A species of avanturine is also produced by heating pieces of quartz to a certain degree and suddenly cooling them; this occasions a number of minute fissures in the mass, which by the unequal refraction of the light gives the stone the desired appearance."

Avícula (Lat. a little bird).—A free, unequal-valved shell, fixing itself by a byssus, the hinge without a tooth, and rather callous, valves somewhat gaping near the beaks. The type of the *Aviculidæ*, which embraces *avicula, posidonomya, aviculo-pecten, gervillia, perna, inoceramus*, and *pinna*. "The living shells or pearl-oysters," says Woodward, "are natives of tropical and temperate seas: there are no living species in northern latitudes, where their fossil forms are very numerous."

Aviculopecten.—The avicula-like pecten, an extensive genus of monomyarian bivalves peculiar to the Carboniferous Limestone, and often so well preserved that even the colours of the living shell are retained. The form in the several species is more elongated than in pecten; valves slightly unequal, and hinge without a tooth.

Axe-stone.—A sub-species of jade, of a deep sea-green or leek colour, used by the New Zealanders, and other natives of the Pacific, for making hatchets, hangers, &c. It is sometimes called *Amazonian stone*, from its being found on the banks of the river Amazon. According to Dr Wakefield, it occurs largely in the middle island of New Zealand.—See JADE.

A'xinite (Gr. *axinê*, an axe).—One of the Garnet family, so called from the axe-like form of its crystals; the Thumerstein of Werner, who found it at Thum in Saxony. "The crystals are attached singly, or united in druses; it also occurs massive in laminar or broadly radiated aggregates, lustre vitreous, colour clove-brown, inclining to smoke-grey or plain blue. According to Wiegmann it consists of 45 silica, 19 alumina, 12.5 lime, 12.25 iron peroxide, 9 manganese peroxide, 2 boracic acid, and 25 magnesia. It is not very abundant, and occurs chiefly in fissures, veins, or subordinate beds, in granite and the metamorphic schists, associated with quartz, felspar, asbestus, &c. The finest crystals are from Dauphiné, and from Cornwall."—(Nicol's *Man. of Mineral.*)

Axis (Lat. *axis*, a pole or axle-tree).—A word used largely and variously in natural science: applied to the line about which objects are symmetrical, about which they are bent, around which they turn, or to which they have some common relation; hence "vertebral axis," "axis of elevation," "synclinal axis," "axis of rotation," "axis of a crystal," &c.

Axótomous (Gr. *axon*, axis, and *temno*, I cut).—Applied to minerals cleavable in one particular direction.

Aýmestry Limestone.—The middle member, according to Murchison's sections, of the Ludlow group of Silurian strata; so named from the village of Aymestry in Herefordshire, where it is well exposed.—See SILURIAN SYSTEM.

Azóic (Gr. *a*, without, and *zoê*, life).—Without life, void of life; a term applied to the lowest or deepest-seated strata in the crust of the globe, such as gneiss, mica-schist, and other crystalline schists, which have yet

yielded no fossils or traces of life to the palæontologist. Used by many as synonymous with *Hypozoic*, *Non-fossiliferous*, and *Metamorphic*, which see.

Azóte (Gr. *a*, priv., and *zoë*, life).—An early, and still used, chemical term for nitrogen, because of its fatal effects (when breathed) on animal life.—See NITROGEN.

Azure Stone (so named from its colour).—A familiar term for *Lapis Lazuli*, which see.

A'zurite (from its colour).—Prismatic azure-spar, or lazulite. A mineral usually occurring in mica-chist, and consisting of alumina, silica, magnesia, lime, and oxide of iron.

B

Bábingtonite (after Babington).—One of the hornblende family; the "axotomous augite-spar" of Mohs. It occurs chiefly in beds of magnetic iron ore, and in veins of quartz and felspar, in small, black, attached crystals; and consists essentially of silica, iron protoxide, and lime.

Bácillaria (Lat. *bacillum*, a little stick).—A genus or rather group of Diatoms, consisting of simple siliceous frustules of a prismatic shape (whence the name), and forming a brilliant chain, which often appears in zigzag, in consequence of incomplete self-division. They abound in all waters, fresh and marine; and fossil species are equally abundant in all the so-called infusorial or microphytal earths.

Back.—A miner's term for "joints;" hence "backs and cutters" applied to jointed structure; the *backs* running in lines less or more parallel to the strike of the strata, and the *cutters* crossing these generally at right angles. —See JOINTS.

Bactrítes.—According to Sandberger, a genus of straight, subconical chambered shells, peculiar to the Devonian epoch; apparently the *Stenoceras* of D'Orbigny.

Báculite (Lat. *baculum*, a staff).—A straight, chambered, conical shell of the chalk epoch; so named from its straight, tapering, staff-like shape. Like other *Ammonitidæ*, it consists of numerous chambers divided by transverse sinuous septa, the outer or inhabited chamber being much larger than the others, and guarded by a dorsal process. The baculites, though not specifically numerous, were individually abundant, and highly characteristic of the cretaceous epoch. From its prevalence in the Chalk of Normandy, that rock is sometimes termed the *Baculite Limestone.*

Bagshot Sands.—A series of lower tertiary beds, consisting chiefly of siliceous sand, and occupying extensive tracts round Bagshot in Surrey, and in the New Forest, Hampshire. They are the equivalents of the Bracklesham beds, and may be separated into three divisions, the upper and lower consisting of light yellow sands, and the middle of dark-green sands and brown clays, the whole reposing on the London Clay.

Baikalite.—A light green, finely-crystallised variety of augite, found in the vicinity of Lake Baikal in Siberia.

Bala Limestone (Bala, in Merionethshire).—A series of dark-coloured, slaty, and sub-crystalline limestones, alternating with black slaty shales, the whole rarely exceeding 20 feet in thickness, and forming a subordinate group of the Lower Silurian, as developed in Wales.—See SILURIAN SYSTEM.

Balaénodon (*Balæna,* and *odous, odontos,* tooth).—Sub-fossil teeth of whales not exactly referable to any known species; *e.g., B. physaloides,* which most nearly resembles the tooth of the cachalot (*Physeter macrocephalus*).—See Owen's *Fossil Mammals.*

Balænidæ (Gr. *phalaina,* Lat. *balæna,* a whale).—The whale family. According to Owen, "the remains of great whales, referable to existing genera or species, have been found in Britain, in gravel adjacent to estuaries or large rivers, in marine drift or shingle, and in the newer Pliocene beds." The remains of the great Airthrey whale, discovered in 1825, and of that found in the Clay-pits of Stirling in 1858, were both imbedded in fine plastic marine silt, varying from 20 to 30 feet above the present medium tide-level of the Firth of Forth.

Bálanite (Lat. *balănus,* a barnacle).—The name given to fossils of the barnacle family, whose shells in general consist of six principal valves arranged in conical form. The cirripeds or barnacles are scarcely, if at all, known till the commencement of the Oolitic era.

Bálas Ruby.—A lapidary's term for the fine rose-red varieties of the spinèl ruby, which see.

Balístes (Gr. *baleso,* I strike as with a dart).—The file-fish, so called from its rough, jagged, and dart-like fin-spines; a cartilaginous fish belonging to the sclerodermatous or hard-skinned division of the *Plectognathi.* The genus is characterised by its sub-globular body, hard, scaly, or granular dermal covering, solid teeth implanted in the jaws, and somewhat resembling the front teeth of man, and by their strong denticulated fin-spines. Speaking of fossil fin-spines or *ichthyodorulites,* Dr Buckland remarks "that the spines of balistes and silurus have not their base, like that of the spines of sharks, simply imbedded in the flesh, and attached to strong muscles; but articulate, with a bone beneath them. The spine of balistes also is kept erect by a second spine behind its base, acting like a bolt or wedge which is simultaneously inserted or withdrawn by the same muscular motion that raises or depresses the spine."

Banwell Cave.—An ossiferous cavern situated in the carboniferous limestone of the Mendip Hills in Somersetshire, and celebrated for its having yielded a number of mammalian remains characteristic of the pleistocene period.—See OSSIFEROUS CAVERNS.

Barbádoes Tar.—A commercial term for petroleum or mineral-tar which is found in several of our West India islands.

Barílla (Span.)—The ashes left by the combustion of *salsola, salicornia, chenopodium,* and other maritime plants. It consists chiefly of an impure carbonate and sulphate of soda, and is used in the manufacture of soap and glass. Like British barilla or *kelp* (obtained from the burning of seaweed), barilla has fallen in demand since the introduction of Le Blanc's method of obtaining soda from common sea-salt.

Bárium (Gr. *barys,* heavy).—The metal of which baryta is the oxide. Like sodium and potassium, it is known only to the chemist; is of a whitish-grey colour; possesses little lustre; and on exposure to air or water becomes rapidly converted into its oxide, *baryta.*

Bárnacle (Sax. *bearn,* child, and *aac,* oak).—Literally "child of the oak," expressive of the old belief that the barnacle or acorn-shell grew on trees. Whether sessile or pedunculated, the barnacles are now well-known articulated animals, either found on rocks or shells at a depth ranging from eight to ten fathoms, or affixed to bottoms of ships and other floating

bodies. They belong to the *Cirripeds* or "curl-footed" order of the Articulata.—See CIRRIPEDA.

Bárolite (Gr. *barys,* heavy, and *lithos,* stone).—Heavy stone; carbonate of baryta, or *Witherite.* According to its discoverer, Dr Withering, it consists of 80 barytes and 20 carbonic acid.

Barosélenite (*barys* and *selenite; selene,* lustre).—Heavy spar; native sulphate of baryta. It occurs both massive and crystallised; generally of lustrous foliated texture, hence the name. Consists of 66 baryta and 34 sulphuric acid.

Barrier Reef.—A name given by voyagers to those coral-reefs which run parallel (*barrier-like*) to the shores of islands and continents, but separated therefrom by a lagoon-channel more or less extensive. The barrier-reefs of Australia and of New Caledonia, owing to their enormous dimensions, have excited much attention.—See CORAL REEFS.

Barystróntianite (*barys* and *strontian*).—Known also as *Stromnite,* from its occurring at Stromness in Orkney. It occurs in greyish or yellowish-white semitranslucent masses, with a faint pearly lustre and crystalline structure; and consists, according to Dr Traill, of 68.6 carbonate of strontian, 27.5 sulphate of baryta, 2.6 carbonate of lime, and a trace of oxide of iron.

Barýtes (Gr. *barys,* heavy).—Heavy spar, or sulphate and carbonate of baryta, which is a protoxide of the metal *barium.* Baryta derives its name from its great specific gravity, which is about 4.2, thus being the heaviest of all the known earths; it is also a violent poison. The native sulphate is generally known as *heavy-spar* or *cawk;* the carbonate as *Witherite,* after its discoverer, Dr Withering. There is also a sulphato-carbonate described by Dr Thompson.

Baryto-Cálcite.—Known also as *Alstonite* from its occurring in the lead-mines of Alston Moor in Cumberland; a mineral consisting of 66 carbonate of baryta, and 34 carbonate of lime.

Basált (Gr. and Lat. *basaltes,* but of unknown origin, some deriving it from a Syriac word, *basil,* baked or burnt; others from an Ethiopic word, *basal,* iron; and others again from *ἅls,* salt, in allusion to its usually crystallised or columnar structure).—A well-known igneous rock occurring in the Trap and Volcanic series, but most abundantly in the former. Basalt belongs to the augitic division of trap-rocks, and consists essentially of augite and felspar—the former predominating. It is close-grained, hard, usually black, and frequently columnar; the columns or rather prisms being three, five, or more sided, regular and jointed. The columnar structure seems to be the result of cooling, and the columns always lie at right angles to the cooling surface; but the columnar structure is by no means essential to basalt, which also occurs tabular and massive, and passes insensibly through basaltic clinkstone and basaltic greenstone to greenstone proper. The typical basalt (like that of Giant's Causeway, Fingal's Cave, Sampson's Ribs near Edinburgh, &c.) generally contains crystals of the olive-green mineral *olivine,* disseminated iron-pyrites, and other substances.—See TRAPPEAN ROCKS.

Basáltic.—Composed of basalt; containing basalt. **Basaltiform,** resembling basalt in its columnar structure.

Básanite (Gr. *basanizo,* to test; hence *basanos,* a touchstone).—Lydian stone or touchstone; a variety of schistose hornstone formerly, and still occasionally, used for testing the purity of gold. Consists of upwards of

75 silica, with lime, magnesia, carbon, and iron. Also a name given by Brongniart to a rock having a base of basalt, with more or less distinct crystals of augite disseminated through it.

Basílosaurus (Gr. *basileus*, a king, and *saurus*, lizard).—Literally "King of the Saurians," the name originally given by Dr Harlan to the huge skeleton (between 70 and 80 feet long) discovered in the eocene beds of Alabama, from the belief that it was of saurian affinity. Now known to be a cetacean or whale, and termed ZEUGLODON, which see.

Basin.—In geology, any dipping or disposition of strata towards a common centre or axis is termed a *basin*, *trough*, or *syncline*. As the natural disposition of strata is less or more horizontal, such basins must have been formed by upheaval and subsidence of the earth's crust; and just in proportion to the intensity of the disturbing causes, so we find basins of greater or less extent, and in which the beds dip at all angles towards the axis of depression. The Tertiary formations often occupy limited areas, and fill up such depressions in the older rocks; hence the use of such phrases as "London Basin," "Paris Basin," "Vienna Basin," &c. In geography, the term applies to the whole extent of valley-shaped or basin-shaped country drained by any river and its tributaries, as the basin of the Forth, &c.

Básset or Basset Edge.—A miner's term for the outcrop or surface-edge of any inclined stratum.—See OUTCROP.

Bastard (Fr.)—Spurious; not genuine. Often applied by workmen to rocks and minerals that are impure, or contain such admixture of impurity as to render them economically worthless; as "bastard limestone," an impure siliceous limestone incapable of being converted into quicklime when burnt in the kiln.

Bay Salt.—A general term for coarse-grained salt, but properly applied to salt obtained by spontaneous or natural evaporation of sea-water in large shallow tanks or *bays*.

Bath-Brick.—A well-known material used for cleaning and polishing metal goods and utensils. It is manufactured at Bridgewater from a tidal deposit of fine siliceous silt, deposited in the river Parret in Somersetshire, at the junction of the fresh and salt water. "The peculiar properties of this material," says Ansted, "are probably owing to the siliceous cases of infusorial animalcules destroyed by the salt tidal-water where it meets the fresh water of the river."

Bath-Stone.—A familiar term for the "great oolite" which is extensively quarried for building purposes in the neighbourhood of Bath.—See OOLITE.

Bathymétrical (Gr. *bathys*, deep, and *metron*, measure).—Applied to the distribution of plants and animals along the sea-bottom, according to the depth of the zone (measuring from the shore) which they inhabit.—See ZONE.

Batráchia (Gr. *bắtrachos*, a frog).—A subdivision of the *Reptilia*, comprising the frog, toad, salamander, and siren. *Batrachian* remains seem to range from the Carboniferous formation upwards.—See REPTILIA.

Batráchnis (Gr. *bàtrăchos*, a frog, and *ichnon*, footprint).—A provisional genus of batrachian or frog-like footprints occurring in the New Red or Triassic sandstones of Corncockle Muir, Dumfriesshire, and described by Sir W. Jardine in his *Ichnology of Annandale.*

Batracholítes (Gr. *batrachos*, frog, and *lithos*, stone).—Fossil remains of

true batrachians or animals of the frog kind. "The skeletons, vestiges of the soft parts, and imprints of the feet of several genera of true batrachians," says Mantell, "occur in a fossil state in tertiary deposits, all of which, like existing races, appear to belong to fresh-water or terrestrial species. In the pliocene or newer tertiary strata, on the banks of the Rhine at Œningen, and in the *papier-kohle* of the Eifel, several species of frog, toad, and newt, have been discovered. Fossil frogs of a small species, very similar to the recent, occur in numbers in a dark shale, overlaid by basalt, in the vicinity of Bombay."

Beach.—The shore of the sea; the strand. Strictly that space along the margin of a tidal sea over which the tide rises and falls.—See RAISED BEACHES.

Béchera.—One of Brongniart's genera of fossil plants with tumid articulate stems and verticillate leaves; now merged into ASTEROPHYLLITES.

Bed.—This term is usually applied both by geologists and quarrymen to a stratum of considerable thickness, and of uniform homogeneous texture —*e.g.* "bed of sandstone," "bed of clay," &c. Originally and strictly, however, the term *bed* referred to the surface-junction of two different strata, and *seam* to the line of separation between them. Thus the upper surface of a stratum may be smooth, or it may be rough and irregular, and the under surface of the stratum deposited on it must partake of this smoothness or this irregularity—this is *bedding;* the line that marks the separation between two strata is the *seam.*

Beetle-stone.—A name given to coprolitic nodules of ironstone, &c., from the fanciful resemblance (when the nodule is split up) of the enclosed coprolite, and its radiating films of calc-spar, to the body and limbs of a beetle. The finest specimens are found in the ferriferous shales of the Coal-measures—many of them being susceptible of a fair polish, which materially assists in bringing out the beetle-like aspects of the fossil. —See SEPTARIA.

Belemnite (Gr. *belĕmnos,* a dart).—An abundant cretaceous and oolitic fossil, apparently the internal bone or shell of extinct naked cephalopods allied to the squid and cuttle-fish. Belemnites are usually found as straight, solid, tapering (dart-like) fossils; but occasionally the upper or chambered portion is attached, and even in some instances the colouring matter of the ink-bag has not been altogether destroyed. The *pen* of the common squid (*loligo*) is a slender and insignificant organ compared with the belemnite and its extinct congeners, which seemed to have thronged the seas of the upper secondary period. Upwards of eighty species have been described, and nearly one-half of these occur in British strata. "A belemnite," says Dr Buckland (*Bridgewater Treatise*), "was a compound internal shell, made up of three essential parts, which are rarely found together in perfect preservation. *First,* A fibro-calcareous cone-shaped shell, terminating at its larger end in a hollow cone. *Secondly,* A conical thin horny sheath or cup, commencing from the base of the hollow cone of the fibro-calcareous sheath, and enlarging rapidly as it extends outwards to a considerable distance. This horny cup formed the anterior chamber of the Belemnite, and contained the ink-bag and some other viscera. *Thirdly,* A thin conical internal-chambered shell, called the *alveolus,* placed within the calcareous hollow cone above described. This chambered portion of the shell is closely allied in form, and in the principles of its construction, both to the Nautilus and Orthoceratite. It is

divided by thin transverse plates into a series of narrow air-chambers or *areolæ* resembling a pile of watch-glasses, gradually diminishing towards the apex. The transverse plates are outwardly convex, and are perforated by a continuous siphuncle, placed on the inferior or ventral margin."

Belémnoteuthis (Gr. *belemnos,* a dart, and *teuthis,* the squid or cuttle-fish).—A genus of the Belemnite family of cephalopods occurring in the lias and oolite, and occasionally so well preserved that the receptacle and ink-bag have been found in their natural relative positions, together with the remains and impressions of the mantle, body, tentacles with their hooks, and the fins! According to Mr Woodward, the Belemnoteuthis had eight nearly equal arms, each furnished with twenty to forty pairs of hooks, forming a double alternating row; and the tentacles, which were not longer than the arms, were similarly provided. In all essential points of structure it is most nearly related to the existing Calamaries (*Teuthidæ*), but in consequence of its posteriorly-pointed shell, its fins were lateral instead of terminal, whilst the chambered structure of its shell and the character of tentacles show that it must be regarded as a type distinct from and equal in importance to the existing Calamaries.

Bellérophon.—An extensive genus of fossil nautiloid shells, consisting of a single chamber like the living Argonaut. They occur in the Silurian, Devonian, and Carboniferous strata—upwards of twenty species being met with in the mountain-limestone. The *Bellerophontidæ* are most generally regarded as belonging to the *Heteropoda,* and allied to the Glass-shell (*carinaria*); though by some they are considered to be a simple form of *Cephalopod.*

Bell-Metal.—A well-known alloy of copper and tin, to which small proportions of other metals (zinc, iron, &c.) are occasionally added, according to the quality of the tone required—the larger the proportion of copper the graver the tone.

Bell-Metal Ore.—A Cornish miner's term for STANNINE or *sulphuret of tin,* in allusion to its brilliant bell-metal colour. As an ore it consists essentially of tin and copper-pyrites.

Belóptera (Gr. *belos,* a dart, and *pteron,* wing).—A curious belemnite-looking organism occurring in Tertiary strata, and evidently the internal bone of a cephalopod, but less pointed than the belemnites, and having a wing-like projection or process on each side; whence the name. As a genus it holds a place intermediate between the Cuttle-fish and the Spirulirostra.

Belosépia (Gr. *belos,* a dart, and *sepia,* the cuttle-fish).—A provisional genus of short, flattened, belemnite-looking organisms occurring in tertiary strata, and evidently the internal bone or shell of a cephalopod allied to the existing *Sepia;* hence the name.

Beloteuthis (Gr. *belos,* a dart, and *teuthis,* a squid or calamary).—A genus of flattened, spear-head-shaped belemnites occurring in the Lias, and so termed from their apparent affinity to the squids or calamaries of existing seas.

Beréngellite.—One of the mineral resins occurring, according to Professor Johnston, in large amorphous masses, having a conchoidal fracture, dark-brown colour inclining to olive, a resinous unpleasant odour, and bitter taste. It consists of 72.40 carbon, 9.28 hydrogen, and 18.31 oxygen. It is said to form a lake in the province of St Juan de Berengela in South America, and is used at Arica to caulk vessels.

Berg (Swedish *berg*, a mountain).—An abbreviated term for ice-berg, which see.

Berg-Mahl (Swedish).—Literally "mountain-meal;" a recent infusorial or rather microphytal earth of a whitish colour and mealy grain; hence the name, and hence also the term "*fossil farina*," by which it is occasionally designated. Such earths are of common occurrence in bog and ancient lake-deposits (as in Finland, Iceland, San Fiora in Tuscany, &c.), and consist almost exclusively of the siliceous shields of microscopic plant-growths (Diatoms) and of Infusoriæ. In times of scarcity the Finns and Laps are said to mix the *berg-mahl* with their food, just as the Indians swallow similar clays to appease the cravings of hunger; but analysis does not seem to indicate the presence of any nutritive principle.

Béryl.—A lapidary's term for the less brilliant and colourless varieties of the emerald—this want of colour arising from the absence of chromium, which gives to the emerald its deep rich green. The finest beryls or *aqua marine* are found in Siberia, chiefly in druses or veins in granite, along with rock-crystal or tourmaline and topaz. Some crystals exceed a foot in length, but others of still larger dimensions have been found in the United States. Esteemed gems also occur in the granites of Wicklow and Aberdeen; in Norway, Bavaria, the tin-mines of Bohemia, and other localities.—See EMERALD.

Beryx.—A genus of ctenoid fishes belonging to the Perch family, the living species of which inhabit the seas of Australia. A number of species have been obtained from the chalk of the south-east of England, where it is one of the most common ichthyolites, and known to the quarrymen by the name of "Johnny Dory." The specimens are short, robust, perch-like fishes from four to twelve inches long, having very large heads, large eye-orbits, broad opercular pieces covered with sculptured rays, and the margins of the jaws furnished with a broad band of brush-teeth. The body is covered with large round scales having several concentric rows of denticles, and the single dorsal-fin has several spinous rays in front of the soft rays.

Berzeline (after Berzelius, the chemist).—Seleniuret of copper, occurring in crystalline dendritic crusts in fissures of calc-spar in the copper-mines of Sweden and Saxony.

Bérzelite (after Berzelius).—A name given to several minerals in honour of the great Swedish chemist. The *Berzelite* of Kühn is a honey-coloured, massive arseniate of lime and magnesia; the *Berzelite* of Lévy a muriate of lead—a very rare mineral, generally known as *Mendipite* from its occurring in the Mendip Hills, Somersetshire.

Beyrichia (after M. Beyrich).—A genus of minute phyllopodous crustaceans belonging to the family *Limnadiadæ*, of which the existing Limnadia has been taken as the type. They are bivalved, and their minute three-lobed-like coverings occur in profusion both in lower and upper silurian strata, but more abundantly in the latter—where hundreds, from the size of pin-heads and upwards, may be seen attached to the crusts of Eurypterites, as if they had led, like many of their existing congeners, a parasitic life on crustaceans and fishes.

Bi (Lat. *bis*, twice).—A frequent prefix signifying *two*, *twice*, or *in twos;* as *bimana*, two-handed; *biennial*, living for two years, or occurring every second year; *bifurcate*, two-forked, and so on.

Bicúspid (Lat. *bis*, and *cuspis*, a spear).—Two-pointed; two-fanged;

two-pronged. The "false molars" or pre-molar teeth in the human subject are frequently termed the *bicuspids*.

Biénnial (Lat. *bis*, and *annus*, a year).—In Botany, enduring throughout two years and then perishing; applied to plants which do not bear flowers and seed till the second year, and then die.

Bífid (Lat. *bis*, twice, and *findo*, *fidi*, I cleave).—Cleft or cloven into two; opening with a cleft, but not deeply divided.

Bifúrcated, Bifurcation (Lat. *bis*, and *furca*, a fork).—Forked; divided into two heads or branches.

Biláteral Symmetry (Lat. *bis*, both, and *latus*, the side).—That construction in vertebrate animals by which the organs of the body are arranged more or less distinctly in pairs on each side of the body.

Bímana (Lat. *bis*, twice, and *manus*, hand).—Literally two-handed. In Zoology, the order of mammalia of which Man is the sole representative; the apes and monkeys being *quadrumanous*, or four-handed.—See tabulations, "Animal Scheme."

Bind.—A miner's term for tough, argillaceous, or clayey shales; but, like many other local terms, not very precise in its application.

Binómial System (Lat. *bis*, two, and *nomen*, a name).—That system in zoological nomenclature, according to which every animal receives two names—one indicating the *genus* to which it belongs, the other being its own *specific* appellation. Thus, the genus *Felis* includes the cat, tiger, leopard, panther, lion, &c.; but these being different species, are each distinguished by a second term, as *Felis cattus*, the common cat; *Felis tigris*, the tiger; *Felis leopardus*, the leopard, and so forth.

Bíology (Gr. *bios*, life, and *logos*, doctrine).—The science of Life, whether vegetable or animal, embracing botany and zoology in their widest acceptation.—**Biological**, relating to the science of life; life in all its multifarious manifestations and developments.

Bíolite (after M. Biot).—Hausmann's term for the *rhombohedral talc-mica* of Mohs, and the *magnesia-mica* of other mineralogists.—See MICA.

Bísmuth (Ger. *wismuth*).—One of the metals, having a reddish silver-white colour, very sectile, non-malleable, and readily fusible, even in the flame of a candle. It occurs *native*, associated with the ores of cobalt, silver, and tin; and also as an oxide, under the name of *bismuth ochre;* as a sulphuret, called *bismuthine* or *bismuth glance;* as a sulphuret with copper, known as *copper bismuth ore;* with copper and lead, called *aciculite* or *needle ore;* and in several other less important combinations.—See FUSIBLE METAL.

Bísmuth-blende.—Silicate of bismuth, or rather a mixture of silicate of iron and bismuth, with phosphate of alumina. Known also as EULYTINE, which see.

Bísmuthine.—Sulphuret of bismuth or bismuth-glance; occurring chiefly in the granitic and metamorphic rocks, either in long longitudinally striated prismatic crystals, or massive, or disseminated in granular or columnar aggregates. It is rather soft, sectile, of a greyish tin colour, and consists of 81.5 bismuth, and 18.5 sulphur.

Bísmuthite.—A yellowish-grey ore of bismuth, occurring disseminated or in investing incrustations, and consisting essentially of carbonate of bismuth, with a little of the sulphate, and mixed with traces of iron, copper, and sulphuric acid as impurities.

Bitúmen (Gr. *pitus*, the pine or pitch-tree).—Mineral pitch or tar. As a genus, the Bitumens belong to the family of "Mineral resins," or hydro-

carbons, are highly inflammable, and burn like pitch with much smoke and flame. They occur in numerous localities, and are associated with almost every formation, from the Silurian upwards. They appear to be natural distillations or chemical conversions from substances of organic origin (animal as well as vegetable), and present themselves most abundantly in volcanic districts. At the same time it must be noted, that bituminous exudations take place among Lower Silurian or even Cambrian strata, formations in which only a few scattered sea-weeds and zoophytes occur; and hence the ingenious surmise of M. Abich, that in such cases bitumen is a *primitive compound,* engendered in the interior of the earth, whence it arises like carbonic acid and nitrogen, of which the real origin is also unknown. Be this as it may (though the occurrence of anthracites in these early formations would seem to negative the notion), there can be no doubt of the organic origin of bitumen in a majority of instances. In its purest and most fluid state it constitutes *naphtha* (86 carbon, 14 hydrogen); when of the consistence of oil, it is known as *petroleum* (1 to 8 per cent of nitrogen, oxygen, and ashes); in its next stage of inspissation it is called *maltha,* or slaggy mineral pitch; then *elaterite* or elastic bitumen; and ultimately it becomes indurated into *asphalt,* which varies considerably in purity—some specimens yielding from 8 to 14 per cent of oxygen and nitrogen, and from 4 to 6 per cent of inorganic ashes.

Bitúminous, &c. (See *Bitumen*).—Containing bitumen, or having the properties of bitumen; *bituminiferous,* yielding bitumen naturally, or by distillation; *bituminated,* impregnated or prepared with bitumen; *bituminise,* to prepare or coat with bitumen; and *bituminisation,* the natural process of being converted into bituminous matter, as vegetable debris into coal.

Bitterspar.—Known also as *Rhomb-spar;* a mineralogical term for the larger-grained, distinctly crystallised, and cleavable varieties of *dolomite,* which see. "Bitterspar, it has been well remarked, bears the same relation to dolomite and magnesian limestone that calcareous spar does to common limestone."

Bívalve (Lat. *bis,* and *valvæ,* folding doors).—Applied to mollusca that have two valves or shells, as the cockle and mussel; in contradistinction to those that are one-shelled (*univalve*) and many-shelled (*multi-valve*).

Black-Band.—A Scotch miner's term for those ironstones (clay carbonates) of the coal-measures which contain coaly matter, sufficient to calcine the ore without any artificial addition of fuel.—See IRONSTONE.

Black-Chalk.—A soft black or bluish black clay or shale, occurring in subordinate layers in several formations, and owing its colour and softness to the presence of from 10 to 15 per cent of carbon; *e.g.,* Italian Chalk, German Chalk, &c.

Black-Jack.—A Derbyshire miner's term for the sulphuret of zinc; the *Blende* of the mineralogist, which see.

Black-Lead.—A familiar term for GRAPHITE, from its resemblance to the metal lead; called also, for the same reason, *Plumbago,* which see.

Black-Wad.—An earthy ore of manganese, more commonly known as *Wad,* which see.

Blanching (Fr. *blanche,* white).—The process of whitening the leaves and stems of plants by excluding the light.—See ETIOLATE.

Blende (Ger. *blenden,* to dazzle).—A term applied by mineralogists to several minerals having a peculiar lustre or glimmer, as horn-blende, zinc-

blende, ruby-blende, &c.; but now chiefly applied to a metallic ore of zinc—the sulphuret or "black-jack" of the English miner.

Blind-Coal.—A miner's term for anthracite, and for those varieties of common coal which have been in a great measure deprived of their bitumen, and hence burn away *blindly*, or without flame and light.

Blood-Stone.—Known also as *heliotrope;* a variety of Calcedony of a dark-green colour, and sprinkled with deep-red spots; hence its name.—See HELIOTROPE.

Blowers.—In coal mining, the puffs or jets of carburetted hydrogen given off by fissures in the coal during the operations of the miner. These discharges are frequently emitted with considerable force, and many are of long continuance, evincing that certain coal-seams are still undergoing the chemical process of mineralisation or metamorphosis.

Blue John.—A miner's term for Fluor or Derbyshire spar, which see.

Blue-Vitriol.—A familiar term for sulphate of copper, in contradistinction to *green-vitriol,* or sulphate of iron.

Bluffs.—An American term for high banks, presenting a precipitous front to the sea or to a river, as the Bluffs of the Mississippi.

Bog (Celtic, *soft*).—In Scotland and Ireland the common designation for a wet spongy morass, chiefly composed of decayed vegetable matter. *Bog-earth,* soils consisting of light siliceous sand, with a large proportion of decomposed vegetable matter.

Bog-Butter.—A name given to fatty spermaceti-like masses, occasionally found in the peat-mosses of Ireland and Scotland, apparently varieties of *adipocerite,* which see.

Bog-Iron-Ore.—A porous ferruginous deposit occurring at the bottom of many bogs and peat-mosses, and occasionally in such quantities as to be of industrial importance. In general, bog-iron forms a thin cake or pan of iron-peroxide, and evidently results from the decomposition and precipitation of the carbonates and oxides of iron held in solution by the waters of the morass, and which have been carried thither by springs and other discharges of water. By the decay of the vegetable matter, certain acids (carbonic, crenic, &c.) are formed, and a number of chemical changes and interchanges are set agoing, which results in the precipitation of the ore in question. Ehrenberg has detected numerous infusorial forms in bog-iron, but these can only be considered co-ordinate with, and not the primal cause of the formation in question. For an account of the chemical actions and reactions concerned in the formation of bog-iron, and for considerations connected with its formation, as bearing on the origin of iron-stone in general, see Bischof's *Physical and Chemical Geology,* vol. i.

Bog-Wood.—The trunks and larger branches of trees dug up from peat-bogs. The term is usually applied to the "black-oak" obtained from the bogs of Ireland and Scotland, and which derives its ebony colour from an inpregnation of iron.

Bohémia, in Central Europe, rendered classical in geology from its containing one of the most complete and intelligible known developments of Silurian strata, which have been made the subject of an admirable monograph by M. Barrande—*Systême Siluriên de Bohême.*

Boiling Point.—The precise temperature at which a liquid begins to *boil* or bubble up under the influence of heat. The boiling points of liquids are constant under precisely the same circumstances. The causes which induce variation are increased or diminished atmospheric pressure,

the greater or less depth of the liquid, and the nature of the vessel in which it is contained. Thus, the boiling point of water under ordinary circumstances, at the level of the sea, is 212° Fahr.; but it will boil and bubble up at a much lower temperature on the top of a high mountain, in consequence of diminished pressure; it will also boil sooner and more quietly in a rough-surfaced vessel than in a smooth and polished one; and also more quickly in a shallow vessel, in consequence of the less resistance by the superincumbent water to the escape of steam. The boiling point is also raised considerably by saline admixture, so that pure water, which boils at 212°, requires 285° when fully saturated with salt. *In vacuo*, all liquids boil at a temperature 124° lower than in the open air, at the ordinary pressure of the atmosphere. From these facts the reader may readily infer the enormous temperature to which water may be heated in the depth of the earth without boiling or passing off in vapour, and may also judge of the terrific force with which it must explode or pass off in steam as it approaches the vents and orifices of volcanoes.

Bolderberg Beds.—The sands and gravels of the Bolderberg hill, about forty miles E.N.E. of Brussels, are the Belgian representatives of the middle or eocene tertiaries, and often referred to by geologists.

Bole (Gr. *bolos,* a clod or lump of earth).—A term somewhat loosely applied by geologists to friable clayey shales or earths, usually highly coloured by peroxide of iron; hence their yellow-red and brownish-black colours. In Mineralogy the term is applied to certain hydrous silicates of alumina and iron peroxide, in various proportions, *e.g.* 42 silica, 24 alumina, and 24 water, with traces of lime and magnesia. When the magnesia is in notable proportion, the boles become greasy or soapy in feel; hence the terms "mountain-soap," the "fett-bol" of the Germans, and the "Sinopian" and "Lemnian earths" of antiquity, which see.

Bológnian or Bolognése Stone.—A radiated variety of sulphate of barytes, found near Bologna, which, after being heated and placed in the sun's rays, phosphoresces in the dark.

Bone Bed.—A term applied to several thin strata or layers, from their containing innumerable fragments of fossil bones, scales, teeth, coprolites, and other organic debris. One of the best known is that which caps the New Red Sandstone in the south of England. It is found at Axmouth in Devonshire, and at Westbury and Aust in Gloucestershire—places fully sixty miles apart—the bed itself never being more than two or three feet thick, and frequently only as many inches. Another occurs at the junction of the Upper Silurian and Old Red Sandstone in Herefordshire. It is rarely more than a foot thick, and often only one or two inches, and has been traced at intervals over a space of forty-five miles, from Pyrton Passage to the banks of the Teme near Ludlow.

Bone Breccia.—A conglomerate, or rather admixture of fragments of limestone and bones, cemented together into a hard rock by a reddish calcareous concretion, and occurring in caverns, fissures, and the like, of later tertiary date. This breccia is found in almost all the islands on the shores of the Mediterranean Sea, as at Gibraltar, Cette, Nice, Corsica, Palermo, &c.; in many of the ossiferous caverns of Europe; and similar admixtures occur also in the bone caves of England. Bone breccias of analogous date, but containing the bones of marsupial animals only, have been found in the caves of Australia.—See Ossiferous Caverns.

Bone Earth. — The earthy or mineral part of bones, which consists chiefly of the phosphate of lime.

Boracic Acid. — The *sassoline* of some mineralogists; a compound of boron and oxygen occurring in minute pearly scales in crusts, or stalactitic aggregates, in the neighbourhood of hot springs and volcanoes. Upwards of 200,000 lb. are annually obtained from the hot springs or lagoni of Tuscany, by evaporating the water.

Bóracite. — Borate of magnesia; an anhydrous compound of magnesia and boracic acid, consisting of 30.2 magnesia and 69.8 boracic acid. It is usually associated with gypsum; but a compact variety occurs in Germany, forming beds with rock-salt and gypsum.

Borax.—Native borate or bi-borate of soda, found associated with rock-salt in loose crystals in the clay on the shore of certain lakes in Thibet and Nepaul, in South America and in Ceylon. In its rough or impure state it is known as *tincal*, and from this the pure borax of commerce is derived. Borax forms the most valuable reagent for blowpipe experiments; is used in the preparation of fine glass, in medicine, and in South America as a flux for smelting copper.

Bord.—A miner's term for the face of coal parallel to the natural fissures, in contradistinction to *End*, which is at right angles to the natural fissuring.

Bore.—A violent rush of tidal water; the advancing edge or front of the tidal wave as it ascends a river or estuary; *e.g.*, the "bore" of the Ganges, the Severn, &c.

Bornia.—Sternberg's term for a genus of coal-measure plants with verticillate leaves; the same as the *Asterophyllites equisetiformis* of Brongniart and Lindley.

Bornite. — The "purple copper" and "variegated copper" of some mineralogists; an ore of copper of a reddish pinchbeck colour and pale-blue tarnish; mostly found massive and disseminated in rocks of various ages, as in the copper-slate of Germany, the crystalline schists of Norway, &c.; and consisting of about 60 copper, 14 iron, and 26 sulphur.—See COPPER.

Boron.—In chemistry one of the elementary substances; the indecomposable base of boracic acid, from which it was obtained by Davy, by the action of the voltaic battery.

Boss (Fr. *bosse*).—A knob or protuberance; a convenient term in Geology for rounded masses of rock that have resisted denudation, for sudden mound-like swellings of quaquaversal strata, and for sudden protrusions of trap or other igneous rock.

Bothrodéndron (Gr. *bothros*, a pit or cavity, and *dendron*, a tree).—A genus of coal-measure stems with dotted surfaces, and distinguished from sigillaria and stigmaria by two opposite rows of deep *oval* concavities which appear to have been made by the bases of large cones or seed-bracts (*Fossil Flora*, vol. ii.) In the *Ulodendron* (which see) the pit-like scars are *rounder* and more closely placed, while the surface of the stem is covered with tesselated scales like the lepidodendron, and not dotted.

Botryoidal (Gr. *botrys*, a bunch of grapes).—Applied to certain concretionary forms, as those occurring in the magnesian limestones of Durham, the hæmatites of Westmoreland, &c., which resemble clusters of grapes.

Botrýolite (Gr. *botrys*, a bunch of grapes, and *lithos*, stone).—A variety of *Datholite*, or borate of lime, occurring in small botryoidal or reniform crusts in the magnetic iron-ore of Arendal in Norway.

Bottom Beds.—A term occasionally employed by English geologists to designate those partially or doubtfully fossiliferous strata which immediately underlie the Silurian system in Wales. They constitute the Lower Cambrian formation of Sedgwick, and embrace the Bangor slates, Harlech grits, and Llanberis schists.

Boulders (Sax.)—Any rounded or water-worn blocks of stone, which would not, from their size, be regarded as pebbles or gravel, are termed *boulders.* The name, however, is usually restricted to the large water-worn and smoothed blocks ("erratic blocks") found imbedded in the clays and gravels of the Drift formation of the Pleistocene epoch.

Boulder Clay.—A term in frequent use by British geologists to designate those stiff, tenacious, unlaminated clays of the glacial or "Drift" epoch, which are widely spread over Great Britain, and easily distinguishable from other clays by the numerous boulders and pebbles interspersed throughout their mass. These water-worn blocks have evidently been dropt in deep water from floating ice, and have settled in the clayey silt, without regard to specific gravity, or any other arrangement. The clay itself usually partakes of the colour of the formations from whose immediate waste it has been derived: red in old red sandstone tracts, dark-blue in coal-bearing districts, and creamy or chalky white in oolite and chalk areas.—See DRIFT.

Bourgueticrinus (after M. Bourguet).—A genus of encrinites occurring in the chalk and lower tertiaries, and much resembling *Apiocrinus,* under which it was at one time included.

Boúrnonite.—A plumbo-cupreous sulphuret of antimony, named after Count Bournon, who first discovered it at Endellion in Cornwall, and hence known also as *Endellionite.* It is of a steel-grey colour, and occurs in thick tabular crystals or massive in granular aggregates, and consists of 41.8 lead, 12.9 copper, 26 antimony, and 19.3 sulphur.

Bóvey Coal.—A local designation for the tertiary lignite or brown coal which occurs at Bovey in Devonshire, where it is worked for the potteries. There are several beds, varying from two to sixteen feet in thickness, and interstratified with clays—the whole forming a local deposit of limited extent. The lignite appears in every degree of purity, from the woody-looking "board coal" of the miner to a soft earthy mass almost undistinguishable from peat.—See LIGNITE.

Bóvidæ (Lat. *bos, bovis,* an ox). — The ox tribe; a well-known family of ruminants, whose remains are not known to occur in deposits of older date than the pliocene and pleistocene tertiaries. "At those periods," says Owen, "there existed in Britain a very large species of bison (*Bison priscus*), and a large species of ox (*Bos antiquus*) from fresh-water pliocene beds; whilst a somewhat smaller but still stupendous wild ox (*B. primigenius*) has left its remains in pleistocene marls, both in England and Scotland. With this was associated an aboriginal British ox of much smaller stature, and with short horns (*B. longifrons*), which continued to exist until the historical period, and was probably the source of the domesticated cattle of the Celtic races before the Roman invasion. A buffalo not distinguishable from the musk kind (*Bubalus moschatus*), now confined to the northern latitudes of North America, roamed over similar latitudes of Europe and Asia, in company with the hair-clad elephants (Mammoths) and rhinoceroses."—*British Fossil Mammals.*

Brachiópoda (Gr. *brachion,* an arm, and *pous, podos,* a foot).—A numer-

ous order of mollusca, including equal and unequal valved genera, and having one shell placed on the back of the animal, and the other in front. They have no special breathing organs, but the mantle performs that office: they take their name from two long, spiral, ciliated arms, developed from the sides of the mouth, which they can uncoil and protrude, and with which they create currents that bring them food; *e.g.*, *terebratula*, *spirifer*, *productus*, &c.—See MOLLUSCA and PALLIOBRANCHIATA.

Brachiolítes (Gr. *brachion*, an arm, and *lithos*, stone).—A fossil zoophyte or bryozoon occurring abundantly in the chalk of the south of England, presenting a puckered or folded fungiform appearance, and furnished with radical and *lateral* processes; whence the name.—See Mr Toulmin Smith's *Memoir on the Ventriculidæ.*

Brachy.—A Greek word signifying *short*, and frequently made use of in scientific compounds; as *brachyurous*, short-tailed; *brachypteryx*, short-winged; *brachycera*, short-horned, &c.

Brachyphýllum (Gr. *brachys*, short, and *phyllum*, leaf).—A coniferous-looking plant occurring in terminal twigs and branches in the oolitic formation, and so called from the short, ovate, ribless, scale-like leaves which surround the branches. Judging from its leaves and general aspect, Lindley would ally it with the *Araucaria*, *Callitris*, and *Dacrydium.*

Brachyúra (Gr. *brachys*, short, and *oura*, tail).—A sub-order of the Decapod crustaceans, in which the abdomen is always converted into a short jointed tail, quite destitute of terminal appendages, and bent round so as to fold closely under the breast, as in the common edible crabs. The brachyura are not known in a fossil state earlier than the Lower Cretaceous or Greensand period.

Bracklesham Beds.—A series of lower tertiary sands and clays immediately overlying the London clay, and so called from being well exposed at Bracklesham Bay, near Chichester, in Sussex. They contain the gigantic cerithium, volutes, cowries, bones of fishes, crocodiles, and sea-serpents; and thus seem to favour the idea of a warm climate having prevailed in these latitudes during the period of their deposit.

Bradford Clay.—A member of the Oolitic system, equivalent with, or immediately overlying, the Great Oolite. It is well developed near Bradford, and consists of a pale greyish clay, slightly calcareous, and enclosing thin slabs of tough brownish limestone. It rarely exceeds sixty feet in thickness, and is remarkable for the number of its *Apiocrinites*, which are consequently sometimes termed the "Bradford Encrinite."

Brard's Process.—A method adopted by M. Brard to discover in a short time the relative resistance offered by different kinds of rock to the action of damp and frost, and therefore to determine their durability with reference to exposure. It consists in boiling small cubes of the stones to be tested in a saturated solution of sulphate of soda (Glauber's salts), and then suspending them for four or five days in the open air. As they dry they become covered with an effloresence of crystals, which must be successively washed off till the efflorescence ceases. If the stone resists the decomposing action of damp and frost, the salt does not force out any portions of the stone with it; on the other hand, if it yields to this action, small fragments will be perceived to separate themselves, and the cube will gradually lose its angles and sharp edges. The amount of this disintegration affords, according to the author of the process, a criterion of what

would be produced in course of time by the action of the weather. According to other authorities, the expansion of water under frost, and the almost inappreciable expansion of Glauber salt while crystallising, are so very different things, that the one cannot by any means be taken as a test of the effects of the other.

Brash.—"In almost every country," says Sir Charles Lyell, "the alluvium consists in its upper part of transported materials, but it often passes downwards into a mass of broken and angular fragments, derived from the subjacent rocks. To this mass the provincial name of 'rubble' or 'brash' is given in many parts of England. It may be referred to the weathering or disintegration of stone on the spot,—the effects of air and water, sun and frost, and chemical decomposition."—See CORNBRASH.

Brattice.—In coal-mining, an underground wall or partition made of wood, or faced up with wood, to prevent the escape of gases or water, or to alter the current of ventilation.

Breast.—A miner's term for the face or front of a coal-seam at which he is working.

Bréccia (Ital. a crumb or fragment).—A term applied to any rock composed of an agglutination of *angular* fragments, as "volcanic breccia," "osseous breccia," "calcareous breccia," &c. A *breccia*, or *brecciated rock*, differs from a conglomerate in having its component fragments irregular and angular, whereas the pebbles of the latter are rounded and water-worn. The origin of many breccias and breccio-conglomerates is extremely puzzling to geologists. Many of them seem to point to the action of frost on exposed rock-surfaces, and to the transporting power of ground and river ice for their deposit in water; *e.g.* the Permian Breccias of Devon and Annandale.

Breíthauptite (after Breithaupt).—Antimonial nickel; occurring in the Hartz with ores of cobalt, lead, zinc, and pyrargyrite; either crystalline, arborescent, or disseminated; of a light copper-red, with a violet-blue tarnish; and consisting of 31.4 nickel, and 68.6 antimony.

Brewsterite (after Sir D. Brewster).—One of the Zeolite family, occurring in short prismatic crystals, formed by several vertical prisms, and consisting of 54 silica, 17 alumina, 8.7 strontia, 6.4 baryta with lime, and 13.5 water.

Brick-Clay.—The familiar term for any clay used in the manufacture of bricks, tiles, and the like. A good *brick-clay* consists of a tolerably pure silicate of alumina, combined with sand in various proportions, and free from lime and other alkaline earth, of which there ought not to be more than 2 per cent,—more than this acting as a flux in the brick-kiln. A little iron is also present in most varieties; hence the red colour of the bricks as the iron passes into the state of peroxide. Brick-clays are generally superficial deposits, but may also be obtained from any of the stratified formations.——In geological classification, the term "Brick-clay" is frequently used in contradistinction to that of "Boulder-clay"—meaning thereby those finely laminated clays of the Pleistocene epoch which immediately overlie the true boulder-clay, and have evidently been derived from it by the wasting and re-assorting agency of water.

Bristol-Stone, or **Bristol-Diamond.**—A familiar term for small brilliant crystals of quartz or rock-crystal, occurring in the limestones of Clifton, near Bristol.

Brittleness.—That quality of minerals and other solids by which they admit of being easily broken into fragments. The opposite of tough or tenacious: thus a substance may be *hard* yet *brittle*, be *soft* and yet *tenacious.*

Brómine (Gr. *bromos*, a stench).—One of the non-metallic elements, discovered by M. Balard of Montpelier in 1826. It occurs in the state of a deep-red liquid, having a fetid odour somewhat resembling chlorine, and is usually obtained from the uncrystallisable residuum of sea water called *bittern.* It is found, however, not only in sea water, but in several salt springs, as well as in certain marine plants and animals.

Bromite.—Bromic-silver, an ore of silver occurring in olive-green grains, and consisting of 57.5 silver and 42.5 bromine. It is often mixed with carbonate of lead, peroxide of iron, and clay, and is found in the silver mines of Mexico and South America, where it is termed *verde plata*, or "green silver."

Bróngniartin (after Brongniart), known also as *Glauberite.*—A double sulphate of soda and lime—a rare salt, occurring in connection with rock-salt and clay.

Bróntes (Gr. *brontes*, a giant).—A genus of Devonian trilobites, especially characterised by their broad, radiating, fan-like tail, and so termed from their great size compared with the other genera of the family. Little is known of the true form of the head or disposition of the eyes.

Brontozóum (Gr. *brontes*, a giant, and *zoon*, an animal).—A provisional name given by Professor Hitchcock to certain gigantic bird-like footmarks discovered in the new red sandstone of Massachusetts and Connecticut. Some of these footmarks, as those of the *B. parallelum*, are fully 20 inches in length, with a corresponding breadth or divarication of the toes.—(*Silliman's Journal* for 1847.)

Bronze (Fr.)—A well and anciently-known alloy of tin and copper—the proportions of the admixture varying according to the purposes to which it was to be applied, and the hardness and toughness depending more on the mode of tempering than on the relative quantities of the ingredients. Ancient bronze usually contains from 4 to 15 per cent of tin.

Bronzite.—A variety of diallage or schiller-spar, so called from its metallic lustre and pinchbeck or clove-brown colour. It differs from diallage and schiller-spar in being less fusible, and also by its greater hardness and specific gravity.—See SCHILLER-SPAR.

Brown Coal.—Another name for tertiary lignite, in allusion to its colour, as distinguished from the clear, shining, or crystalline black of true coal. "Wood-coal," "bituminous wood," and "board-coal," are occasional local synonyms.—See LIGNITE.

Brown Spar.—Siderite, sphærosiderite, or sparry carbonate of iron; an abundant ore of iron consisting generally of from 50 to 60 per cent of iron protoxide, and from 30 to 40 carbonic acid, with traces of lime, manganese, and other minor impurities.—See IRON.

Brucite.—A native hydrate of magnesia, consisting of 69 magnesia and 31 water; a synonym also given to *Condrodite* or *Chrysolite*, which consists of silica, magnesia, fluorine, and iron.

Bruckmannia (after Bruckmann).—Count Sternberg's term for certain closely-jointed stems with verticillate leaves which occur in the coal-measures, now ranked under the general head ASTEROPHYLLITES.

Bryozóa (Gr. *bryos*, moss, and *zoon*, animal).—This term embraces all the minute mollusca which inhabit compound structures, and which were

formerly regarded as zoophytes or corallines—*e.g.*, *retepora*, *fenestella*, *polypora*, &c. The term (introduced by Ehrenberg) has reference to their branched and moss-like aggregation.—See POLYZOA.

Bucholzite.—Known also as fibrolite; a term for the finely-fibrous varieties of Andalusite, after M. Bucholz.

Bucking (in mining), crushing ore.—A *bucking-iron* is the tool (a flattish hammer) with which the ore is crushed by the hand; a *bucking-plate* is the plate on which the ore is bucked.

Búcklandite (after Buckland).—A variety of epidote or prismatoidal augite-spar, occurring in small black crystals in the granitic rocks, and described as a pure iron epidote.

Buddle (in mining).—A pit, trough, or frame filled with water, by means of which ores are separated from earthy substances by washing.

Búfonite (Lat. *bufo*, a toad).—Literally toad-stone; a name given to the fossil teeth and palatal bones of fishes belonging to the family of *Pycnodonts* (thick-teeth), whose remains occur abundantly in the oolitic and chalk formations. The term *bufonite*, like those of "serpent's eyes," "batrachites," and "crapaudines," by which they are also known, refers to the vulgar notion that those organisms were originally formed in the heads of serpents, frogs, and toads.

Bumástus (Gr. a bunch of large grapes—literally each large as a cow's nipple, *bou* and *mastos*).—A genus or sub-genus of Silurian trilobites, so called from their oblong-oval or grape-like form, and known to collectors as the "Barr Trilobite," from their plentiful occurrence in the limestone of Barr, in Staffordshire. In *bumastus*, which may be regarded as a sub-generic form of *Ilænus*, the general form is oblong-oval and very convex; the head, thorax, and abdomen are of nearly equal length; the head and tail plates much rounded; the eyes smooth and not granulose; the thorax of ten narrow segments, in which the trilobation is scarcely discernible; and in most species the crust studded with minute punctures.

Bunch.—A miner's term for an irregular lump of ore—more than a stone, and not so much as a continuous vein. A mine is said to be *bunchy* when the yield is irregular—sometimes rich, sometimes poor.

Bunter (Ger. variegated).—The German term for the New Red Sandstone of English geologists, in allusion to its variegated colour; the lowest group of the TRIASSIC SYSTEM, which see.

Bupréstis.—A genus of Coleopterous insects remarkable for their brilliant metallic tints; chiefly inhabitants of warm and intertropical climates, and frequenters of woods and pine-forests. Their *elytra* or wing-sheaths have been long known in the Oolitic flags of Stonesfield, near Oxford.

Burdiehouse.—About three miles south from Edinburgh, situated on the lower coal-measures, and celebrated for its estuary or fresh-water limestone, which has yielded many fine fishes (*palæoniscus*, *amblypterus*, *megalichthys*, *rhizodus*, *holoptychius*, &c.), and beautifully preserved plants, as *sphenopteris*, *calamites*, *asterophyllites*, *stigmaria*, *lepidodendron*, *lepidostrobus*, &c.—See Dr Hibbert's paper in 13th vol. *Trans. Royal Soc. of Edinburgh*, and Page in *Brit. Assoc. Reports* for 1855.

Burrh or **Burr-stone.**—A name given to certain siliceous or rather siliceo-calcareous rocks, whose dressed surfaces present a *burr* or keen-cutting texture; hence their use as millstones. The most esteemed varieties are obtained from the upper fresh-water beds of the Paris basin, and from the eocene strata of South America. The French burrhs are porous, or rather

vesicular, in texture, and of a whitish or cream colour. They are extensively used in this country.

Býssolite (Gr. *byssos*, fine flax, and *lithos*).—A somewhat indefinite term applied to fine fibrous varieties of amianthus, tremolite, actinolite, and other filamentous minerals.

Býssus (Gr. *byssos*, fine flax).—In Conchology, the fine silky filaments by which the pinna, mussel, and other bivalves attach themselves to the rocks and sea-bottom. In Botany, the silky tufts of mould or fungus-growth which spring from damp and decaying substances.

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Cáchalong.—A variety of opal, so called from its being found in great beauty on the borders of the river Cach in Bucharia. In the Kalmuc language, *cholong* is said to signify a precious stone. According to Forchammer, a cachalong from the Faröe Islands yielded 95.32 silica, 3.47 water, iron peroxide a trace, .07 potash, .06 soda, .06 lime, and .40 magnesia.—See OPAL.

Cádent (Lat.)—Falling; the tenth of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian chain—the "Declining Day" of the North American palæozoics, and the equivalent of our lower-middle Devonian.—See tabulations, "Geological Scheme."

Cádmium.—A bluish-white metal, discovered by Stronmeyer and Hermann in several of the ores of zinc, and named from *cadmia fossilis*, an old term for zinc ore. Cadmium greatly resembles tin in appearance, but it is harder than that metal; it is very malleable; melts a little below 500° Fahr., and is about as volatile as mercury.

Caen Stone.—The French equivalent of our "Great or Bath Oolite," an oolitic limestone so termed from its being extensively quarried in the neighbourhood of Caen in Normandy, where it is developed in thick nearly horizontal beds. As a building-stone it is of admirable quality; soft in the quarry, of a delicate uniform cream colour, and extreme fineness of texture, but hardens on exposure, and is found to be exceedingly durable.

Cainozóic or **Cænozoic** (Gr. *kainos*, recent, and *zoe*, life).—Applied to the upper stratified systems holding recent forms of life, as distinguished from *Mesozoic* (holding intermediate) and *Palæozoic* (holding ancient and extinct forms). As a palæontological division, the Cainozoic embraces the Tertiary and Post-tertiary systems of British geologists.—See tabulations, "Geological Scheme."

Cairngorm.—A brownish-yellow or amber-coloured variety of rock-crystal, so called from its being found in great perfection in the mountain Cairngorm, Aberdeenshire. "It was formerly much valued," says Professor J. Nicoll, "for ornamental purposes, and an Edinburgh lapidary cut nearly £400 worth of jewellery out of a single crystal."—See QUARTZ.

Caithness Flags.—A well-known series of dark-coloured bituminous flaggy beds, slightly micaceous and calcareous, of great toughness and durability, and largely employed for paving. They belong to the lower-middle portion of the Old Red Sandstone as developed in Scotland, and are celebrated for their abundance and variety of fossil fishes—as *coccosteus*,

pterichthys, dipterus, diplopterus, cheiracanthus, asterolepis, &c.—See Agassiz, *Poissons Fossiles des Vieux Grès Rouge*, and Miller's *Old Red Sandstone.*

Cálaite.—A mineralogical term for the *turquois*, from its being supposed to be the precious stone alluded to by Pliny under the name of *Callais.*

Calamine.—The common name for the *carbonate of zinc*, which occurs, massive or crystallised, in beds and veins in the crystalline and transition rocks, and also in the carboniferous and oolitic formations. It is most common in limestone, and is often associated with calc-spar, quartz, blende, and ores of iron and lead.

Calamítes (Lat. *calamus*, a reed).—A genus of fossil stems occurring abundantly in the coal-measures, and so termed from their resemblance to gigantic reeds. Their true affinities, however, are not well known, and all that can as yet be said of them is, that they were tall hollow articulated stems, furnished with leaves or branches at the joints, possessing a distinctly separable wood and bark, and readily disarticulating at the nodi. The surface of their wood was marked with numerous parallel furrows, which gives to the fossil stems their striated or channeled appearance; the leaf or branch scars are observable at all the joints, and their substance seems to have been so soft as to offer little or no resistance to pressure. According to some, they seem analogous to reeds, but this opinion is not well founded. Brongniart would ally them to the equisetums; but Lindley and others regard their true affinities as yet undiscovered. This much seems certain, that they were both numerically and specifically abundant, and that their habitat was the soft marshy silt of the river edge and estuary.

Calamodéndron (*calamus*, a reed, and *dendron*, tree).—Literally "reed-tree;" one of Brongniart's genera of coal-measure plants, often of considerable thickness, and having their surfaces or outer barks smooth, their stems solid, and containing a deeply striated, articulated, reed-like pith; hence the name. Their real nature and affinity to the ordinary *calamite* are by no means satisfactorily determined.

Calamophýllia (*calamus*, a reed, and *phyllon*, a leaf).—A genus of mesozoic or oolitic corals, so called by Milne Edwards from their being composed of masses of radiating tubes, with striated reed-like surfaces. Individual masses have been found several feet in diameter—the progeny, like the existing brain-coral, of a single germ.—Known also as EUNOMIA.

Calcaire-Grossier (Fr., literally coarse limestone).—An important member of the eocene beds of the Paris basin; usually co-ordinated with the Barton, Bagshot, and Bracklesham beds of the English tertiaries.

Calcaire Silícieux.—A designation of the French geologists for a compact siliceous limestone of the Paris basin, which sometimes takes the place of the *Calcaire Grossier.*

Calcáreous (Lat. *calx, calcis*, lime).—Composed of or containing a considerable portion of lime. Thus we speak of *calcareous spar*, which is a pure carbonate of lime, and of *calcareous shale* or *calcareous sandstone*, which only contain a portion of lime. Geologists also compound the term, as *calcareo-argillaceous, calcareo-siliceous*, &c.

Calcédony (Lat. *calcedonius*, found at Calcedon, in Bithynia).—A semi-transparent siliceous mineral, of the quartz family, closely allied to the opal and agate, and often found associated with them in geodes and vein-bands. It is usually uncrystallised, of a uniform milky-white or pale yellow, and, when occurring as an incrustation or sinter, has a wavy internal structure and peculiar mammillated surface.

Calcéola (Lat., a little shoe or slipper).—A fossil brachiopod, so called from its under or ventral valve, which is flatly conical, or compressed like the point of a shoe, and fitted with an opercular or lid-like upper valve. It is characteristic of the middle Devonian period, and so abundant in the schists underlying the Eifel limestone, that these are known to German geologists as "Calceola-schiefer."

Calcíferous (Lat. *calx*, lime, and *fero*, I bear).—Producing or containing lime; applied to groups of strata containing subordinate beds of limestone; *e.g.*, "calciferous grits," "calciferous sandstones"—the latter term being usually applied to the Lower Coal-measures in the neighbourhood of Edinburgh, after Mr C. Maclaren, who first made use of the designation; the equivalents of the carboniferous slates of the Irish geologists.

Calcine (Lat. *calx, calcis*, lime).—To reduce by fire to a calx or friable substance; **Calcination**, the process of reducing any ore or mineral to a calx by the application of heat. Thus *chalk*, by burning, is reduced to *lime*, and *gypsum* to *plaster-of-Paris*.

Cálcium (Lat. *calx*, quicklime).—The metallic basis of lime originally discovered by Sir Humphrey Davy. It is a whiter metal than strontium and barium, and is extremely oxidable, rapidly becoming the *protoxide*, or quicklime, on exposure to the atmosphere.

Calc-Sinter (Ger., *sintern*, to drop).—This term is usually applied to compact stalagmitical or stalactitical deposits from calcareous waters. The gradual increment of calc-sinter is usually marked by lines or layers of varying hardness and colour.—See SINTER and CALC-TUFF.

Calc-Spar or **Calcareous Spar.**—The general term for crystallised carbonate of lime, which occurs in a vast variety of forms, and in various degrees of purity—from the pure pellucid rhombs of *Iceland spar* to the confusedly crystalline aggregates of the ordinary marbles. The primitive crystal of calc-spar is rhombohedral, with obtuse angles of 105° 8′ and 74° 52′. The derivative forms and combinations are said to exceed 600; they are all easily cleavable, and when irregular are readily distinguished from quartz by being easily scratched, or by effervescing under acids. Calc-spar, in its purest form, consists of 44 carbonic acid and 56 lime; or 40 calcium, 12 carbon, and 48 oxygen.—See LIMESTONE.

Calc-Tuff, or **Calcareous Tufa.**—A porous or vesicular carbonate of lime, generally deposited near the sources and along the courses of calcareous springs, incrusting and binding together moss, twigs, shells, and other objects that lie in the way. Occasionally, when such springs discharge themselves into lakes and seas, beds of considerable thickness are formed, producing a light calcareous rock like the *travertine* of Italy. When slowly formed in the open air, compact incrustations are the usual result, and these are known by the name of *calc-sinter*. In these calcareous springs, commonly known as "petrifying springs," the lime is held in solution by an excess of carbonic acid, or by heat, if it be a hot spring, until the water in issuing from the earth cools or loses part of its acid, and then the calcareous matter is precipitated in a solid state.

Caldéra.—A Spanish term for the deep caldron-like cavities which occur on the summits of extinct volcanic mountains and islands, and evidently the extinguished craters of ancient volcanoes.

Calédonite.—A mineralogical term for a cupreous sulphato-carbonate of lead, occurring in long prismatic crystals, or in acicular tufts of a fine

verdigris or mountain-green; transparent or translucent, and having a resinous lustre. So called by Beudant from its being found at Leadhills in Scotland (Caledonia).

Calliard (Gr. *challis*, Fr. *caillon*, a flinty pebble).—A local name for any hard siliceous stone; often applied by English miners and quarrymen to beds of cherty or siliceous limestone.

Calp.—A provincial Irish term for an impure argillaceous limestone, or rather argillo-ferruginous limestone; hence the name *calp-slates*, adopted by Mr Griffiths for a considerable thickness of shale, argillaceous limestone (calp), and flaggy sandstone, which occurs between the two great bands of carboniferous limestone, as developed in Ireland. The *calp-slates* lie above the lower band, the *carboniferous slates* beneath it.

Calyméne (Gr. *kekalymene*, concealed, obscure).—A genus of trilobites, deriving its name from the obscurity which long hung over the real nature of these crustaceans; the "Dudley Trilobite" or "Dudley Locust" of collectors. The genus occurs throughout the Silurian system, but more especially in the Ludlow rocks of England, and is distinguished by its ovate, convex, and deeply-trilobed shell or crust, which is found either expanded or coiled up like the *oniscus* or wood-louse. The common *calymene Blumenbachii*, or "Dudley Trilobite," is found from one to five inches in length; has the head or cephalic shield large, convex, rounded in front with a well-marked border, boldly three-lobed, and having the two compound facetted eyes set widely apart on the sides of the shield; the thoracic portion consists of thirteen segments, and the pygidium or tail-plate is small and nearly semicircular.

Cámbrian (*Cambria*, the ancient name for Wales).—Belonging to Wales. In Geology, a term employed by Professor Sedgwick to designate the lowest fossiliferous rocks as developed in North Wales. As originally employed, the term embraced several series of strata (the Caradoc or May Hill sandstone, the Llandeilo flags, and the Bala limestone), which are now universally regarded as *Lower Silurian*. If the term is still to be employed in geological classification, it must be used to embrace those slaty, gritty, and siliceous beds, in which traces of life are occasionally found, and which lie between the Metamorphic or Crystalline rocks on the one hand, and the highly fossiliferous Silurians on the other. The subject is one which has given rise to much, and not a little angry, discussion; but as we have elsewhere observed, "if it shall be found in the progress of discovery, that the fossil forms in these strata are specifically the same as the fossils of the Lower Silurian, then whatever their mineral composition or stratigraphical relations, geologists will have no alternative but to regard them as a portion of the Silurian system. If, on the other hand, a majority of their fossil forms shall prove to be specifically distinct from those of the Silurian—even should there be a number of species common to both series of strata—then must we adopt in part the views of Professor Sedgwick, and erect the CAMBRIAN into a distinct and independent system." In the present state of our knowledge, little detriment can arise to the progress of the science by regarding the "Cumbrian" and "Cambrian rocks" of Sedgwick either as a provisional system under the title *Cambrian*, or merely as the basis or "*bottom rocks*" of the Silurian system of Murchison. In his *Tabular View of Fossiliferous Strata*, Sir Charles Lyell adopts the former alternative, and embraces under the term Cambrian such strata as the Lingula flags of N. Wales, the Stiper stones of Shropshire,

the lower greywacke of the south of Scotland, and the lowest fossiliferous rocks of Wicklow in Ireland.

Camélidæ (Lat. *camelus,* a camel).—The Camel Family, which includes the true camels of the Eastern Hemisphere and the llamas of the Western. They are the only ruminants having incisors in the upper jaw, and are now a limited family; though remains of an extinct species have been found in the tertiaries of the Siwalik hills in India, and of allied genera, such as *sivatherium* from the same deposits, and *macrauchenia* from the later tertiaries of South America.

Campílodíscus (Gr. *kampylos,* bent, and *discus,* a quoit or disc).—A genus of Tertiary foraminiferous organisms; so called from their form, which is that of an oval disc, somewhat incurved or bent inwards upon itself.

Cáncellated (Lat. *cancelli,* a grating of bars, lattice-work).—Latticed; anything which is cross-barred, or marked by lines which cross each other at right angles. This cancellated arrangement is common in leaves, in bones of certain mammals, in the bryozoa, and other organic structures.

Cánine, Canines (Lat. *canis,* a dog).—Dog-like; partaking of the nature of, or exhibiting the characteristics of the dog-tribe. The "canines" or canine teeth in mammals are those strong, sharp-pointed teeth (one on each side in either jaw), inserted between the incisors and premolars; and are so termed from their well-marked development in the dog, for whom, as for other animals possessed of them, they perform the function of cutting and tearing.—See TEETH.

Cánnel Coal.—A compact, brittle, jet-like variety of coal, sonorous when struck, breaks with a conchoidal fracture, and does not soil the fingers when handled. It is said to derive its name from the candle-like light it yields when burning; and is known to the Scotch miners as "parrot-coal," from the crackling, chattering noise it emits when first thrown into the fire. It occurs interstratified in the coal-measures of certain districts along with ordinary coal, and often forms, in the Scotch coal-fields, the upper portion of a seam of splint coal, or even of a bed of black-band ironstone. Occasionally these ironstones become so bituminous as to pass into a cannel coal more or less pure; and *vice versâ,* a cannel coal often becomes so ferriferous as to afford an available ironstone. Cannel coal appears to have been formed either by the greater maceration of the vegetable mass, or under such conditions as permitted a more equable and thorough bituminisation than in ordinary coal. It is used chiefly in the manufacture of gas, for which it is admirably fitted; and some of the more lustrous and tougher varieties are worked, like jet, into ornaments and curiosities.

Capíllary (Lat. *capillus,* a hair).—Hair-like. Applied to amianthus, certain zeolites, and other minerals whose crystals occur in filaments or fine *hair-like* masses; also to fine tubes less than the twentieth of an inch in diameter, and capable of sustaining or attracting any liquid considerably above the level at which they may be immersed. This *capillary attraction,* as it is termed, is a phenomenon which occurs less or more in all porous bodies—the minute interstices acting as capillary tubes, and "drawing" or "attracting" any liquid considerably above the level of its mass.

Cáradoc Sandstone.—The upper member or series of the "Lower Silurian" formation, as it occurs in the hilly range of Caer Caradoc in Shropshire, from which it takes its name (*Caractacus,* king of the ancient Britons, corrupted Caradoc). In the typical district, the Caradoc group consists of sandy shales, courses of shelly sandstone occasionally passing

into bastard limestone, and light-coloured siliceous sandstones and grits. They are worked as freestones, and notwithstanding their soft and sectile character, these Caradoc sandstones are laden with a profusion of fossils of the same species as occur in the slaty argillaceous rocks of large tracts of Wales; *e.g.* Snowdon and Bala.—See SILURIAN SYSTEM.

Cárapace (Gr. *karabos*, a crustaceous animal).—A general term for the crustaceous and horny coverings of certain classes of animals, which, like the plates of the armadillo, the horny shell of the tortoise, and the calcareous crusts of the crab, protect the internal parts from injury, and become, as it were, a sort of external skeletons. The term, however, is mainly applied to the shields of the tortoises, crustacea, and infusorial animalcules.

Carbon (Lat. *carbo*, the inflammable matter forming charcoal).—Carbon is one of the elementary substances, and in its pure form exists only in the diamond. By combustion in oxygen it forms carbonic acid gas. In its impure or mixed forms carbon occurs largely in nature, as in the substance of all wood plants; in the tissues of animals; and abundantly in many minerals, as in the coals, bitumens, mineral resins, &c.

Carbonáceous (Lat. *carbo*, coal).—Coaly; applied to rocks containing abundant traces of fossil carbon, or vegetable debris; hence "carbonaceous shales," "carbonaceous sandstones," &c.

Cárbonate.—In Chemistry, any compound of carbonic acid with a base; as carbonate of lime, carbonate of iron, &c.

Carbónic Acid.—An acid formed by the chemical union of carbon and oxygen. It is the gas given off during the effervescing of soda-water, champagne, and other similar liquids. It occurs largely in nature, being given off by volcanic vents, by fissures in mines, caves, and wells, by many mineral waters, by the respiration of animals, and during the decay of vegetable substances. It is an essential ingredient of all calcareous rock-masses (carbonate of lime), and an active agent of disintegration, whether combined with the atmosphere or with the waters that percolate through the rocky strata.

Carboníferous (Lat. *carbo*, coal, and *fero*, I bear).—Coal-bearing; coal-yielding. The term is usually applied to that system of Palæozoic strata from which our main supplies of coal are obtained, or to the respective groups or members of that system; hence we speak not only of the "carboniferous system," but of the "carboniferous limestone," the "carboniferous slates," and so forth.

Carboniferous System.—That formation, or system of fossiliferous strata which, in order of time, succeeds the Old Red Sandstone, and is in turn surmounted by the Permian or New Red Sandstone of the earlier English geologists. As a system, it constitutes the younger or upper portion of the Palæozoic cycle, and derives its importance from being, in Britain, North America, and other countries, the great repository from which are obtained the chief supplies of COAL, so indispensable to the industrial arts and manufactures of modern civilisation. *Lithologically*, the system consists of alternations of sandstones, shales, clays, limestones, coals, and ironstones, in every degree of admixture and purity, and of every condition of formation—terrestrial, fresh-water, estuary, and marine. *Palæontologically*, there have been discovered in its strata representatives of all the great forms of life, with the exception, perhaps, of true dicotyledonous plants in its *Flora*, and of birds and mammals in its *Fauna*. As its name

implies, the most striking peculiarity in the formation is the profusion of fossil vegetation, which marks less or more almost every stratum, and which in numerous instances forms thick seams of solid coal. Although this *coaly* or *carbonaceous* aspect prevails throughout the whole, it has been found convenient to arrange the system into three groups—the Lower Coal-measures or Carboniferous Slates, the Mountain or Carboniferous Limestone, and the Upper or True Coal-measures; or more minutely, as is generally done by British geologists, into—

1. Upper Coal-measures.
2. Millstone Grit.
3. Mountain Limestone; and
4. Lower Coal-measures.

Other subdivisions have been attempted according to the local peculiarities of different coal-fields; but it is enough for the purposes of the general reader to know, that all these minor arrangements can be readily co-ordinated with one or other of the above four series. Thus Sir R. Griffiths, in his *Geological Map of Ireland*, gives the annexed subdivisions:—

a. Coal-measures, upper and lower, .	1000 to 2200 feet.
b. Millstone Grit, ...	350 ,, 1800 ,,
c. Mountain Limestone, upper, middle, and lower, ...	1200 ,, 6400 ,,
d. Carboniferous Slate, . . .	700 ,, 1200 ,,
e. Yellow Sandstones (of Mayo, &c.), with shales and limestones, . .	400 ,, 2000 ,,

Now, here there is this little difficulty in co-ordinating, as we have first the usual members of the system, *a*, *b*, *c*, and *d*, and a subjacent series, which lies fairly open to the question whether it is not the equivalent of the "yellow sandstones" which form the uppermost portion of the Old Red Sandstone or Devonian system in other localities. Again, the carboniferous strata of the south of England (on the Avon, near Bristol) are given in the *Geological Survey's Memoirs* as consisting of:—

a. Millstone Grit—here mostly a hard reddish grit-stone, the grains often almost confluent, as in what are called quartzites and quartz-rocks, .	950 feet.
b. Alternations of Limestone, red or grey, compact or granular, with shales, red, dark, or grey, and sandstones. Most of the strata fossiliferous, and Producta gigantea abundant near the base, .	400 ,,
c. Scar Limestones—grey, reddish, mottled, brown, and black; compact, shelly, crinoidal, and oolitic, in beds varying in thickness, and partially divided by shales, ...	1440 ,,
d. Lower Series, enclosing many alternations of limestones and shales, the former often black, brown, yellowish, sometimes impure, and in one part charged with fish-remains and cyprides in abundance, ...	500 ,,

*** The upper part of the Old Red shows yellow and grey sandstones and marls.

In this case there can be no difficulty in at once assigning *b* and *c* to the great series of the Mountain Limestone; while *d* is evidently the equivalent of the "Lower Coal-measures" of Scotland, with a few of its beds

graduating, it may be, into the yellow sandstones of the underlying Devonian. In Fifeshire, on the other hand, we have—

a. True Coal-measures—consisting of numerous alternations of coal, shales, sandstones, ironstones, and occasional beds of impure limestone, .	2500 feet.
b. Several strata of crinoidal and productus limestone, with intervening beds of shale, sandstones, and thin seams of coal, ...	200 ,,
c. A vast thickness of whitish fine-grained sandstones, bituminous shales, a few thin seams of coal, mussel-bands or shell-limestone, and fresh-water limestones abounding in cyprides, . .	2000 ,,

In this instance there is no development of millstone grit — the whole system resolving itself, as it does in many other regions, into Upper Coal, Mountain Limestone, and Lower Coal. In Nova Scotia, again, we have in the lower series a vast development of gypseous beds, which look somewhat puzzling at first sight to an English geologist; but which, when taken in connection with the associated shales and coals and fossils, admit of easy co-ordination on the large scale with the main subdivisions established by British geology. How far these subdivisions may indicate separate life-periods, or only portions of one great epoch, has yet to be determined by a more minute and rigorous comparison both of vegetable and animal species. In the mean time, existing evidence rather favours the latter opinion, and geologists are nearly at one in regarding the carboniferous system as a great Life-period characterised from all others by many forms of a varied marine and estuary *Fauna*—its gigantic sauroid fishes, crustaceans, encrinites, and corals; but in particular by the vast profusion of its endogenous *Flora*—its *stigmaria, sigillaria, lepidodendra, favulariæ, Knorriæ, bothrodendra, ulodendra, calamites, asterophyllites,* and *filicites*—plants which rose, culminated, and died out with the period, never again to be repeated in the onward phases of vegetable development.

Carchárodon (Gr.)—Literally "jagged tooth;" a genus of Tertiary sharks, so termed from their notched or jagged teeth, which are often of great size, and indicating dimensions more than double that of the largest existing species. The living genus *Carcharias* comprises the large sharks with cutting triangular teeth, crenated or notched on their margins, and having a broad base. In the extinct *Carcharodon* the teeth differ from those of Carcharias in being solid in the centre, while in the latter they are hollow; but in both genera the teeth exhibit the same reticulated structure of medullary and calcigerous tubes.

Carcharópsis (Gr.)—Literally "shark-like;" a genus of carboniferous shark-like fishes, founded by Agassiz on their teeth—the only portions yet discovered. These teeth occur in the carboniferous limestone; are compressed, triangular, crenated on the edges, with large plaits or folds in the enamelled surface, towards the base of the crown.

Cardíglio Marble.—A grey, clouded variety of marble obtained for ornamental purposes from the island of Corsica.

Cardiocárpon (Gr. *kardia*, the heart, and *karpos*, fruit).—A genus of small heart-shaped seeds occurring in groups on the shales of the coal-measures as if they had grown in clusters. Supposed by Brongniart to be *Lycopodiaceous;* by others, to have fallen from some species of *asterophyl-*

lites; and by Lindley, to have, like other genera of the coal era, no very positive modern analogy.

Cárdium (Gr. *kardia,* the heart).—The cockle-shell, so named in allusion to its heart-like form; a well-known dimyarian bivalve occurring in many specific forms, both recent and fossil, in almost every sea, and from the Lias upwards. The cockle-like bivalves occurring in palæozoic formations are *Cardiola, Cardiomorpha,* and similar provisional genera: *Cardita, Cardinia, Cardilia,* &c., are chiefly mesozoic and neozoic forms, and belong to the family CYPRINIDÆ.

Carnélian (Lat. *caro, carnis,* flesh).—Applied originally to a flesh-coloured variety of calcedony; but now a lapidary's term for the more transparent varieties, whether brown, blood-red, yellow, white, or almost black. Carnelian is uniform in colour, or it may be less or more clouded, but it is never figured or striped like the agates. The colouring matter seems to be peroxide of iron, which may be acted upon by heat so as to convert specimens originally yellow into a fine deep red, as is done with those found at Cambaya, near Surat. The finest carnelians are found in India, Arabia, Surinam, and Siberia; but fair specimens are also obtained from Bohemia, Saxony, and Scotland. According to Heintz, a Chinese variety yielded—silica, 99.37; alumina, .081; iron peroxide, .050; magnesia, .028; potash, .004; soda, .075; carbon, .003; and water, .391.

Carnívora (Lat. *caro, carnis,* flesh, and *voro,* I devour).—One of Cuvier's orders of the mammalia (hyæna, tiger, &c.), so called from their subsisting solely on flesh. **Carnivorous,** living on flesh, in contradistinction to *herbivorous, frugivorous,* &c. See tabulations, "ANIMAL SCHEME."

Carpolíthes (Gr. *carpos,* fruit, and *lithos,* stone).—The general term for fossil fruits, such as those found in the tertiary clays of the London basin, in the coal-shales of Newcastle, &c.

Carrára Marble.—A pure white, semi-transparent saccharoid marble obtained from the mountains of Massa Carrara in Italy, and highly valued for statuary purposes. It is an altered or metamorphic limestone of the Oolitic period.

Caryophýllia (Gr. *karyophyllon,* a clove).—Literally "clove-shaped;" a genus or section of lamellated Anthozoarian corals occurring from the upper silurian to the chalk inclusive. The polyparium or calcareous axis is turbinated or cylindrical, simple or branched, longitudinally striated, fixed at the base; the cells boldly lamellated.

Cascálho (Span.)—The name given in Brazil to the auriferous or gold-bearing detritus of the country. "The common cascalho," says Ansted, "is an indurated soil in which gold is contained, and seems to consist of the fragments of veins which have been by some means broken up, rolled about by the action of water, and buried by it among the clays which have composed its bed." The cascalho is also the principal repository of the Brazilian diamonds.

Cassíterite (Gr. *kassiteros,* tin).—A mineralogical term for the oxide of tin, or ordinary tin-ore, which consists of 79 tin and 21 oxygen, but often mixed with impurities of iron peroxide, silica, manganese, and the like.

Cátaclysm (Gr. *kataklysmos,* inundation).—Any violent flood or inundation that overspreads or sweeps over a country; deluge; debacle.—**Cataclysmal;** applied to the effects or destructive power of such violent inundations.

Caténipóra (Lat. *catena,* a chain, and *pora,* cell).—Chain-pore coral; a

genus peculiar to palæozoic strata, and so termed from the chain-like arrangement of its pores or cells in polished specimens. In *catenipora* the polyparium is hemispherical, composed of vertical anastomosing lamellæ; cells tubular, oval, terminal, and united laterally, so that in transverse sections they present a chain-like arrangement. Often found in hemispherical masses more than a foot in diameter. Known also by the Greek synonym, *Halysites*, which see.

Cat's-Eye.—A variety of crystallised quartz, of a greenish-white or grey, olive green, red, brown, or yellow colour, and containing parallel fibres of amianthus, which produce a peculiar play of light; hence the name. For this peculiar play of light the French use the term *chatoyant.* The finest varieties of this mineral are brought from Ceylon and Malabar.

Caudal (Lat. *cauda,* the tail).—Belonging to or connected with the tail, as "caudal fin," the tail fin; "caudal vertebræ," vertebræ of the tail.

Caudex (Lat. *caudex,* a stem or stock).—In Botany, usually applied to the upright stem of ferns, the leaves of which are technically termed *fronds,* and the root-like or underground stem a *rhizome.*

Caulópteris (Gr. *kaulos,* stem, and *pteris,* fern).—Literally tree-fern; a genus of stems or trunks found in the coal-measures, and by Lindley regarded as decidedly the stems of tree-ferns, in consequence of their shallow sinuous furrows, and spirally-arranged long oval leaf-scars.

Caves, Caverns (Lat. *cavus,* hollow).—Caves occur less or more along the rocky shores of all free-flowing seas, and are the results of abrasion by waves laden with gravel, &c., and acting upon pre-existing fissures or the softer portions of the exposed rocks. The most celebrated caverns, however, occur in limestone strata, and appear to be the results partly of fissuring by subterranean disturbance, and partly of waste by the percolation and passage of carbonated waters. Some are celebrated for their great extent and subterranean waters (Kentucky); others for their gorgeous stalactites and stalagmites (Antiparos); and many, of late, for their treasures of sub-fossil bones (Kirkdale, Kent's-hole), and consequently known as "Bone Caves," or "Ossiferous Caverns," which see.

Cawk.—A familiar term for heavy-spar or native sulphate of barytes, which see.

Célestine (Lat. *cælum,* the sky).—A mineralogical term for sulphate of strontian, in allusion to its colour, which usually ranges from bluish-white to indigo blue, and is rarely reddish or yellow. Celestine occurs in rocks of all ages, but more frequently in the newer formations. Its average composition is 56.5 strontia, 42.5 sulphuric acid; with traces of iron, baryta, lime, and water.

Cemént (Lat. *cæmentum*).—In building, literally chips for filling up the interstices between the larger blocks; now applied to mortar or any similar substance used for uniting other materials, and which ultimately hardens and binds them together. *Roman cement,* a mortar made of lime and puozzolano (volcanic tufa) ground to fine powder; *hydraulic cement,* any mortar that sets rapidly and hardens under water (which see). There are numerous builders' or architects' cements in the market, some for facing walls in imitation of stone, others for setting under water, some for resisting fire, and others for the exclusion of damp (as Gibb's, Parker's, Keene's, Pew's, Martin's, &c.); but in all of them *lime, silica,* and *alumina* in various proportions, and in different states of calcination, are the prime ingredients.

Cephaláspis (Gr. *kephalè*, the head, and *aspis*, a shield).—A fish of the lower Old Red or Devonian period, so called from having the bones of the head united into a single shield-like case, and terminating posteriorly in three pointed spines or prongs—one on each side below, and a third in the mesial or dorsal ridge. The body also seems to have been protected by osseous bands, leaving the tail, pectorals, and other fins free as in the living trunk-fish. There are several species of Cephalaspis, all having the head large in proportion to the body, and none exceeding ten or twelve inches in length. The dentition, and even the position of the mouth, is unknown, though evidently placed beneath the head, and in all likelihood suctorial, as in the living sturgeon. The *Cephalaspidæ* form a very limited family, and embrace such provisional genera as *Cephalaspis* proper, *Auchenaspis*, *Pteraspis*, and others of which very little is yet known.

Cephalópoda (Gr. *kephalè*, the head, and *pous*, *podos*, foot).—The highest class of mollusca, so called from the principal organs of locomotion being attached to the head in the form of muscular arms or tentacles, as in the cuttle-fish and nautilus. In addition to their tentacular organs of motion, many have fin-like processes, and all can propel themselves by the forcible expulsion of water from their respiratory chamber. Of living forms one or two, like the nautilus, have *external* shells; all the others, like the cuttle-fish, are "naked" or shell-less, but possess an *internal* bone or "pen," the representative of the shell. On the other hand, most of the fossil forms, as *orthoceratite*, *ammonite*, &c., have external shells either straight, coiled in a vertical plane, or curved variously; though a large section also of the extinct forms were naked, and possessed internal "pens" or shelly organs which occur abundantly in secondary strata, and are known as *belemnites*, *belemnoteuthites*, and the like. Having numerous organs of prehension, powerful jaws like the mandibles of a parrot, spiny tongues, large eyes, acute senses, active locomotion, and a more concentrated nervous system than other mollusca, the cephalopods, both now and in former ages, appear to have been the tyrant scavengers of the waters. They are all marine and predatory, living on shellfish, crabs, and fishes. They occur fossil in all formations, and appear to have culminated in point of numbers and power during the Oolitic period—each great period having its own peculiar and characteristic forms. It is usual to divide the Cephalopods into two orders—the TETRABRANCHIATA and the DIBRANCHIATA, the former having four branchial plumes, two on each side, and the latter only two branchial plumes, one on each side. The tetrabranchs or Nautiloids form two families, the *Nautilidæ* and *Ammonitidæ*—the former including the existing nautilus (the only living representative of the order), the orthoceratite, lituite, and others having external chambered shells with plain partitions, or sutural junctions and siphuncle more or less central; the latter the extinct ammonites, baculites, and others having also external chambered shells, but these with foliaceous complex sutures, and siphuncle dorsal, or on the back of the chambers. The dibranchs or cuttle-fishes, on the other hand, have almost always internal shells or "pens," which are frequently rudimentary, and when external, or rather pseudo-external, are never chambered. They constitute two main sections—1st, Those with ten tentacular organs (decapoda), such as the *Spiralidæ* or spirulæ, the *Sepiadæ* or cuttle-fishes, the *Loligidæ* or squids, and the fossil *Belemnitidæ* or belemnites; and 2d, Those with eight tentacles (octopoda), such as the *Octopodidæ* or poulpes, and the

Argonautidæ or paper-nautili, which are provided with a thin fragile pseudo-external shell. To the palæontologist many of these distinctions are of prime importance, and are curiously indicative of creational progress. Thus, in the palæozoic genera the sutural junctions are plain and simple, while in the mesozoic they become foliaceous and complex—*nautilites, goniatites, ceratites*, and *ammonites*, not only indicating generic distinctions, but time and successive formations. So also in palæozoic genera their tentacles were void of acetabula or sucking-cups, while those of neozoic periods are almost invariably provided with them. In like manner the *tetrabranchs* preceded the *dibranchs*, and thus while the former is now represented by a single genus, the latter has representative families and genera in every region of the existing ocean.—See tabulations, "Animal Scheme."

Ceratiócaris (Gr. *keration*, a pod, and *kăris*, shrimp).—An upper Silurian crustacean, whose exact affinities are unknown, but whose form apparently connects it with *apus* and *dithyrocaris*. It derives its name from its large, finely-striated, pod-like, bivalved carapace (which has frequently been mistaken for a bivalve shell); and its shrimp-like segmented body, which consists of five or six free segments, terminated by three strong sharp-pointed spines—the *leptocheles* of palæontologists before they were found in attachment. The finest specimens have been found in the upper Silurians of Lesmahago.

Ceratítes (Gr. *keras*, a horn—curved like a ram's horn).—A genus of Ammonitidæ, having the lobes of the sutures peculiarly crenulated. The ceratites are characteristic of the Trias (in which upwards of twenty species have been discovered), and are distinguished from the ammonites of the superincumbent lias and oolite by the absence of foliaceous sutures — the descending lobes terminating in small denticulations, as above described.

Cerátodus (Gr. *keras*, a horn, and *odous*, tooth).—A genus of cestraciont fish-teeth occurring abundantly in the "Bone-bed," between the Trias and Lias formations, and very puzzling from the variety of shapes they assume. They have in general an uneven or undulating upper surface of dentine and enamel, and an under layer of reticulated osseous tissue; the several plates or teeth apparently varying in form according to the position they occupied in the pavement-like palates of the cestraciont.

Cérium.—One of the rarer metals discovered by Hisinger and Berzelius in 1803, in the mineral named *cerite*, which consists of silica and protoxide of cerium with minor proportions of iron, lime, and water, together with the less-known metals *didymium* and *lanthanum*.

Cerússite (Fr. *ceruse*, white-lead).—Carbonate of lead occurring crystallised, fine, granular, or earthy; colourless or white, and often grey or yellowish-white, and consisting of 83 protoxide of lead and 16.4 carbonic acid. It is a common ore of lead, especially in beds or veins with galena (sulphuret of lead), from the decomposition of which it is supposed to be derived; the liberated sulphuric acid acting on calc-spar, whose carbonic acid combines with the protoxide of lead.

Cérvical (Lat. *cervix*, the neck).—Belonging to the neck, as the *cervical* vertebræ, or vetebræ which form the neck.

Cestrácionts, Cestraciontidæ (Gr. *kestra*, a pike, a kind of fish, so called from its formidable teeth).—The first and oldest sub-family of sharks, beginning, says Buckland in his *Bridgewater Treatise*, with the Transition

strata, appearing in every subsequent formation till the commencement of the Tertiary, and having only one living representative—viz., the *Cestracion Philippi*, or Port-Jackson Shark. The character of the cestracionts is marked by the presence of large polygonal obtuse enamelled teeth, covering the interior of the mouth with a kind of tessellated pavement. In some species not less than sixty of these teeth occupied each jaw. They are rarely found connected together in a fossil state, in consequence of the perishable nature of the cartilaginous bones to which they were attached ; hence the spines and teeth usually afford the only evidence of the former existence of these extinct fossil species. They are dispersed abundantly throughout all strata, from the Carboniferous series to the most recent Chalk ; *e.g., psammodus, cladodus, helodus, ceratodus, strophodus, acrodus*, &c.—See tabulations, "Animal Scheme."

Cetácea (Gr. *ketos*, a whale.)—Cuvier's eighth order of mammalia, which includes the whales, dolphins, and other warm-blooded animals inhabiting the ocean. It is now usual to subdivide the order into sections—1st, the CETACEA, including the *Balænidæ* or northern whales, the *Physiteridæ* or sperm whales, and the *Delphinidæ* or dolphins ; and, 2d, the SIRENIA, or herbivorous cetaceans, which embraces the *Rhytinidæ*, and the *Manatidæ* or sea-cows. Remains of cetaceous animals occur only in recent and tertiary strata ; *e.g. Dinotherium* (?), *zeuglodon, balænoptera*, &c.

Cetiosáurus (Gr. *ketos*, whale, and *saurus*, lizard.)—A genus of marine saurians, whose vertebræ and other bones occur in the Oolite and Wealden, and which has been so named by Professor Owen from the presumed general resemblance to the Cetaceans, in the short doubly-concave vertebræ, and the solid bones and natatory character of the extremities.

Cetotolítes (Gr. *ketos*, a whale, and *ous, otos*, the ear, and *lithos*).—A term applied by Owen to the fossil petro-tympanics or ear-bones of whales, which occur abundantly in upper tertiary formations, like the Suffolk and Norfolk "Crag." In general, the peculiar conchoidal-shaped tympanic bone is the only portion preserved.

Ceylaníte.—Known also as *Candite*, from Candy in Ceylon ; a dark-coloured variety of spinel, which see.

Chábasie or Chábasite (Gr. *chabos*, narrow, compressed).—One of the Zeolite family, occurring in compressed, striated, rhombohedral crystals, chiefly in the vesicular cavities and fissures of amygdaloid and other trap-rocks. Its colour is usually white, but sometimes passing into a greyish-yellow or pinkish tinge ; its composition uncertain, analyses giving about 50 silica, 18 alumina, 9 lime, and 20 water, with traces of soda, potash, and iron.

Chalcédony, more frequently *Calcedony*, which see.

Chálcolite (Gr. *chalcos*, bronze, and *lithos*).—A combination of uranium with phosphoric acid and copper, forming a cupreo-phosphate of uranium. It occurs in scales of an emerald or verdigris green colour, and is found in metalliferous veins traversing the granitic rocks and crystalline schists. Differs from URANITE (which see) only in containing copper instead of lime.

Chalk (Lat. *calx*, Ger. *kalk*, lime).—The familiar as well as technical term for the soft and earthy-looking varieties of limestone. The Chalk of the south of England is well known, both as a rock and as the upper member of the *Cretaceous System*, which see. While the *white chalk* of commerce is well known as a soft amorphous carbonate of lime, which can be converted into *quicklime* by calcination, and used for all the purposes of

ordinary limestone, it should be borne in mind that the term "chalk" has also been applied to other substances which are in no sense of the word limestones, as *Red Chalk,* a natural clay containing from 15 to 20 per cent of the protoxide and carbonate of iron; *Brown Chalk,* a familiar name for umber; *Black Chalk,* a variety of drawing-slate; and *French Chalk,* a variety of steatite or soapstone—a well-known soft *magnesian* mineral.—See CRETACEOUS SYSTEM.

Chalýbeate (Gr. *chalybs,* iron or steel).—Applied to springs and waters impregnated with iron, or holding iron in solution. Springs, whose active principle is iron, are of two kinds—the *carbonated,* containing carbonate of the protoxide of iron; and the *sulphated,* containing the sulphate of iron.

Chambered.—Usually applied to shells internally divided into chambers or compartments, like the existing nautilus.

Cháos (Gr. *chaos,* literally an immense void or chasm).—Matter without form or arrangement; according to the poets, the primal condition of the material universe before it was arranged and fashioned into *Cosmos.*—**Chaótic,** confused; thrown together into a vast heap without any order or arrangement, like the debris resulting from a violent land-flood or debacle.

Charcoal.—The carbonaceous residue of animal, vegetable, and combustible mineral substances, when heated to redness in close vessels, or when they undergo smothered combustion. We have thus, lamp-black or *animal charcoal,* derived from oils and fats; *wood charcoal,* from twigs and faggots; and *coke* or *mineral charcoal,* from ordinary pit-coal.—See CARBON.

Chatóyant (Fr.)—Changing in lustre like the cat's-eye; a word expressive of that changeable lustre exhibited by various minerals, as they are turned less or more to the light; *e.g.,* cat's-eye opal, Labrador felspar, &c.

Cheiracánthus (Gr. *cheir,* the hand, and *akantha,* a thorn).—Literally "thorny hand," in allusion to the ichthyodorulite or spine that protects the pectoral fins of this fish. The *Cheiracanthus* belongs to the Acanthod family; is found in Devonian strata; was a small, slim fish, covered with minute, angular, brightly-enamelled scales, each having a slight median ridge; and armed in all its fins with defensive spines.

Cheirólepis (Gr. *cheir,* the hand, and *lepis,* a scale).—Literally "scaly-hand," in allusion to its scaly pectorals; a genus of Devonian fishes belonging to the family Acanthodes, and characterised by the great development of their pectoral and ventral fins, and by the presence only of a small sub-dorsal. In *Cheirolepis* the scales are lozenge-shaped, and richly adorned with minute waving striæ on their posterior margins.

Cheiróptera (Gr. *cheir,* the hand, and *pteron,* a wing.)—Literally "hand-wings,"—the Bats; a well-known order of mammalia, whose fore-feet or *hands* are so modified as to enable them to exercise the power of flight—a power which they alone of all the existing mammalia possess. They are found in all parts of the world, but most abundantly in tropical countries; are crepuscular and nocturnal in their habits; and live, some on insects, others on the blood of the larger mammalia, and others again on fruits. Remains of the order occur in tertiary strata, and also in many of the ossiferous caverns, where they seem to have lodged after the manner of their existing congeners.

Cheirothérium (Gr. *cheir,* the hand, and *therion,* beast).—A term applied by Dr Kaup to an unknown quadruped, the hand-like impressions of whose feet are common on the slabs of the Trias or Upper New Red Sandstone.

It is supposed by Professor Owen to be one and the same with the batrachian or frog-like LABYRINTHODON, which see.

Cheirúrus (Gr. *cheir*, hand, and *oura*, a tail).—Literally "hand-tail;" a genus of Lower Silurian trilobites, so termed from their tail or terminal portion presenting four or five finger-like spines or processes.

Chélæ (Gr. *chelè*, a claw).—Applied particularly to the bifid claws or pincers of the crustacea, the scorpion, &c. Fossil *chelæ* (*Leptocheles*) occur as early as the Upper Silurian epoch.

Chelíchnus (Gr. *chelonè*, a tortoise, and *ichnon*, footprint).—The supposed footprints of tortoises occurring on the slabs of the Permian Sandstones of Corncockle Muir, in Dumfriesshire, and so termed by Sir W. Jardine, who has figured them in his *Ichnology of Annandale.*

Chelónia (Gr. *chelonè*, the tortoise).—In Cuvier's arrangement, the first order of the Reptilia, including the tortoise, the turtle, &c., in which the skeleton of the trunk is external, shell-like, and immovable—the upper portion being termed the *carapace*, and the lower or abdominal plate the *plastron.* Chelonian foot-tracks are supposed to have been discovered as early as the Old Red Sandstone period ; but their actual remains have as yet been found only in the Oolite, Chalk, and Tertiary formations. In the Tertiaries of the Siwalik hills Dr Falconer discovered the carapace of the gigantic *Testudo Atlas*, or *Colossochelys*, measuring about 20 feet in diameter.

Cheropótamus, Chœropotamus (Gr. *choiros*, a hog, and *potamos*, river).—Literally "river-hog;" a pachydermatous quadruped occurring in the Tertiaries of France and England ; very closely related to the hog-family, and forming, as it were, a link between the extinct Anoplothere and the existing Peccary. From its geological position, Professor Owen regards it as the earliest representative of the hog-tribe on our globe ; and from its dentition, considers it to have been more predacious or carnivorous than any of the existing species.

Chert (quasi *quartz*).—A mixed siliceous rock, or rather flinty portions occurring in other strata, as in limestone. Resembles some varieties of flint and hornstone, but less splintery in the fracture, and fusible, which latter property is owing to an admixture, less or more, of calcareous matter. A limestone so siliceous as to be worthless for the limekiln, is said to be "cherty."

Chesil Bank (Ger. *kiesel*, a pebble).—Literally "Pebble-bank;" the well-known shifting pebble beach that extends from Portland to Abbotsbury, on the southern coast of England.

Chiástolite (Gr. *chiastos*, marked with the letter χ, or cleft, and *lithos*, stone).—A crystalline mineral, by some regarded as a variety of *Andalusite*, and by others as a distinct species. It occurs in long four-sided prisms of a pale-grey or greyish-green colour, with a dull vitreous lustre, and is found imbedded in clay-slate, especially near granite, and often appears like four crystals separated by a black cross of the dark slate ; hence the name.

China-Clay.—A general term for the finer varieties of pottery clay, technically known as *Kaolin*, which see.

Chiton (Gr. *chiton*, a coat of mail).—A well-known mollusc, whose shell consists of eight transverse imbricating plates ; *e.g.*, the *C. octovalvis* of our own shores. Chitons occur fossil from the Silurian upwards.

Chlorite (Gr. *chloros*, green).—A soft friable mineral, closely allied in character to talc and mica, and so called from its greenish colour. It is

generally massive and scaly, or imbedded and interspersed through other rocks. "Chlorite," says Nicoll (*Man. of Mineral.*), "is one of the most widely dispersed and geologically important minerals. Externally it resembles mica, and is frequently associated with, or replaces, it in granite, gneiss, and similar rocks. It is a component of the diabase porphyries and amygdaloids, and then often crystallised; and it is occasionally found in diorite, euphotide, and serpentine; more rarely in greenstone-porphyry, amygdaloid, basalt, and trachyte. It is most abundant in chlorite slate, or in beds of potstone, intimately mixed with talc, for which it shows a strong affinity. From these it has passed into various sedimentary rocks, which owe to it their green colour. The Alps, Scandinavia, the Ural, the Harz, and many parts of Scotland, are well-known localities of chlorite, both in its crystallised variety and as a constituent of rocks." According to Kobell, a German variety consisted of silica 27.32, alumina 20.69, magnesia 24.89, iron protoxide 15.23, manganese protoxide 0.47, water 12.00. The most abundant varieties are common chlorite, chlorite slate (which contains upwards of 40 per cent of magnesia), and foliated chlorite.

Chlorític Sand (Gr. *chloros*, green).—Any sand coloured green by an admixture of the simple mineral *chlorite*, which see. The term is generally applied to the "Greensand" of the chalk formation, which owes its prevailing colour to a chloritous silicate of iron.

Chlorophǽite (Gr. *chloros*, green, and *phao*, I appear).—A soft sectile earthy mineral, occurring massive, or disseminated in amygdaloidal trap-rocks; translucent and olive-green when first exposed, but soon changes to blackish-brown, and becomes opaque. Consists of 32.85 silica, 22.08 iron peroxide, 3.44 magnesia, and 41.63 water.

Chlorophâne (Gr. *chloros*, green, and *phaino*, I shine).—A variety of fluor-spar, so called from its exhibiting a bright-green phosphorescent light when heated.

Choanítes (Gr. *choanê*, a funnel).—A genus of spongiform zoophytes occurring in the chalk formation, and usually converted into flint. They are of a sub-ovate form, and appear to have been composed (according to Dr Mantell, who first described them) of a softer tissue than the ordinary sponges. They have a central funnel-like cavity (whence the name), were fixed at the base by long rootlets, and had their mass traversed by numerous channels which opened on the inner surface of the cavity, and which, in transverse sections, gives them the radiating appearance of a sea-anemone, hence the familiar term of "petrified anemones."

Choke-Damp.—A miner's term for carbonic acid gas, as distinct from "fire-damp" or light carburetted hydrogen.—See AFTER-DAMP.

Chondrítes (Lat. *chondrus*, a species of sea-weed).—Fossil marine plants of the Chalk and other formations; so called from their resemblance to the existing *chondrus crispus*, or Irish moss of our own shores. The frond is thick, branched, dichotomous, or forking into cylindrical or claviform divisions, with a smooth surface, and without tubercles.

Chóndrodite (Gr. *chondros*, a grain).—The hemi-prismatic chrysolite of Haüy. One of the gems occurring in grains in crystalline limestone, &c., of various shades of yellow and red; transparent; and consisting of silicate of magnesia, with iron, potash, and fluorine.

Chrome, Chromium (Gr. *chroma*, colour).—One of the metals discovered by Vauquelin in 1797, and so named from its property of imparting colour to other bodies in a remarkable degree. Combined with oxygen it forms

chromic acid, and this again, with other substances, forms *chromates,* as chromate of lead, chromate of iron, &c. In nature, chromium forms the colouring matter of various gems, as the emerald, ruby, &c. ; and in the arts its preparations are extensively used as pigments.

Chrome Ochre.—Oxide of chrome, occurring in loose earthy masses, disseminated or investing, of a fine yellowish-green, but generally so mixed up with the rock in which it occurs as to be separable only by chemical means, and hence termed *chrome-stone.*

Chrómite or Chromate of Iron.—A mineral occurring generally in serpentine or serpentinous limestones, either in veins, in nests, or disseminated. It is used in the preparation of various pigments, as chrome-green, chrome-yellow, &c.

Chrýsoberyl (Gr. *chrysos,* gold, and *beryllion,* a gem).—A species of corundum, of a yellowish or asparagus green, and consisting chiefly of alumina, with glucina and protoxide of iron. When large and transparent it is used as a gem; the opalescent varieties, named *cymophane* (floating light) being most esteemed.

Chrysocólla (Gr. *chrysos,* golden, and *colla,* glue).—A silicate of the protoxide of copper, occurring in botryoidal or reniform crusts, of a fine emerald green, and apparently a secondary production from the decomposition of copper-ores, which it usually accompanies. Derives its name from the weak resinous lustre and peculiar transparency of its fractured edges.

Chrýsolite (Gr. *chrysos,* gold, and *lithos*).—A green-coloured mineral occurring in trap and volcanic rocks, and consisting of about 40 silica, 50 magnesia, and 9 iron, with traces of alumina, manganese, and nickel. The fine green-coloured transparent crystals are known as *chrysolite;* the less pellucid granular masses as *olivine;* and less-known and duller-coloured varieties as *chusite, fazalite, hyalosiderite,* &c.

Chrýsoprase (Gr. *chrysos,* gold, and *prasinos,* leek-green).—A fine apple-green to leek-green variety of calcedony, which owes its colour, according to Klaproth, to a small per-centage of oxide of nickel.

Cídaris, Cidarítes (Gr. *kidaris,* a turban).—A genus of the family *Echinidea* or sea-urchins, characterised by their hemispherical, globular, or sub-oval shape; parallel ambulacra, that is, diverging equally on all sides from the vent to the mouth; vent vertical; mouth beneath and central. Living, and fossil from the carboniferous limestone upwards. Many of the *cidarites* are of large size, and are furnished with long and often curiously ornamented spines.

Cília (Lat. *cilium,* an eyelash).—Applied in Zoology to a peculiar sort of moving organs, resembling microscopic hairs; *e.g.,* the hair-like filaments that surround the mouths of polypes. *Ciliated,* furnished or fringed with cilia; *ciliary motion,* that rapid vibratile motion characteristic of cilia in a state of action.

Cimoliórnis (Gr. *kimolia,* a kind of fuller's clay, and *ornis,* bird).—Literally *Chalk-marl Bird;* a generic term applied by Professor Owen to certain bones from the Lower Chalk-marls, and considered to be those of birds. It is doubtful, however, whether they do not belong to the *Pterodactylus compressirostris,* and until more is known of the osteology of the Pterodactyles, the name must be received merely as provisional.

Címolite.—Cimolian earth; a pure white variety of clay, or hydrous silicate of alumina, so called from its occurring in the island of Cimola.

It is used as a fuller's earth; and, like kaolin, results from the decomposition of felspar in trachyte or other felspathic rock.

Cinder-bed.—A stratum of the Upper Purbeck series, almost wholly composed of oyster-shells; and so named by the quarrymen from its loose incoherent composition.

Cínnabar (Gr. *kinnábari*).—Sulphuret of mercury, occurring in crystals, disseminated and granular, compact, or earthy, and usually of a fine cochineal-red or vermilion colour. It is found in the crystalline, transition, and secondary strata, in beds or veins, and associated with native mercury, iron-pyrites, and other ores. It is the principal ore of mercury, which is obtained from it by sublimation or distillation. The purer varieties are used as a pigment.

Cinnamon Stone.—A variety of garnet, belonging to what is termed the "Lime-alumina" division of the family, and so called from its cinnamon or orange-yellow colour.—See GARNET.

Cípolin or Cipollíno.—An Italian term for a whitish marble, variegated with zones or shadings of green talc or chlorite; and so called from its resemblance to the alternating green and white coats of an onion. (*Cipollina*, a shallot or onion).

Círripedes, Cirrhipédia, Cirrhópoda (Gr. *kirros*, a curl, and *pous, podos*, a foot).—A class of articulated animals, including the barnacles and acorn-shells, which obtain their name (curl-footed) from the many-jointed curled tentacles which terminate their feet. In their adult stage they are furnished with a shelly covering consisting of several pieces, some being sessile, others attached by a long fleshy peduncle. They are found fossil from the oolite upwards—*pollicipes, balanus, scalpellum*, &c.

Clathrária (Lat. *clathrum*, a lattice).—A genus of fossil stems, first discovered by Dr Mantell in the Wealden of Sussex, and so named from the lattice-like arrangement of the lozenge-shaped leaf-scars which ornament their surface. They are evidently gymnogens, and appear to have the nearest relation to the Cycas family, though certain fruits generally found along with them seem to point to the true Coniferae.

Clathrópteris (Lat. *clathrum*, a lattice, and *pteris*, fern).—Literally "Lattice-fern;" a genus of gigantic ferns apparently peculiar to the Wealden. The leaf is deeply pinnatifid; leaflets elongated and traversed by a strong midrib; secondary veins perpendicular to the midrib, and united by transverse branches, which produce a network of quadrangular meshes; hence the name.

Clavate (Lat. *clavus*, a club).—Club-shaped; slender at one extremity, and gradually thickening and terminating obtusely at the other.

Clay Ironstone.—A familiar term for the impure earthy carbonates of iron which occur in nodules, layers, and bands, chiefly in the Coal-formation; hence *clay-band* in contradistinction to *black-band*.—See IRONSTONE.

Claystone.—An earthy felspathic rock of the Trap group, occurring in veins as well as in mountain masses, and differing from compact felspar in being softer, and having the aspect and texture of a baked or indurated clay. It becomes porphyritic by the intermixture of felspar crystals, and is then known as *claystone porphyry*. The prevailing colours among the claystones are buffs and reddish-browns, with various tints approaching to purple.

Cleavage.—That peculiar structure in many fine-grained stratified rocks, such as clay-slate, which renders them capable of being split indefinitely

into thin plates or laminæ, and this in a direction independent of their bedding or stratification. Occasionally the lines of cleavage may coincide with those of bedding when the strata stand at high angles, but for the most part it is transverse, and even often at right angles to the original sedimentary layers. As a superinduced structure occurring among the semi-crystalline or metamorphic strata, its origin has given rise to many hypotheses—the chief of which may be regarded as *mechanical* or *chemical*, according as they are founded on physical or on chemical considerations. Thus, those who regard cleavage as a minute species of jointing, generally running parallel to great axes of elevation, and altogether independent of the strike or dip of the strata through which it passes, adopt the mechanical theory of great lines of cosmical uprise and contraction, which produced immense pressure on the irregular particles or interstitial cavities of the cleaved masses; while those who regard it as a species of crystallisation or new molecular arrangement adopt a chemical view, and ascribe the appearances to the long-continued but as yet imperfectly understood operation of electrical or chemical forces. Professor Sedgwick, for instance, who has directed much of his attention to metamorphic phenomena, propounds a chemico-electrical hypothesis (founded on the artificial production of cleavage by passing magnetic currents through masses of moistened clay), by which "crystalline or polar forces have rearranged whole mountain-masses, producing a beautiful crystalline cleavage, passing alike through all the strata;" while Professor Phillips appeals in the main to "mechanical forces compressing the sediment at right angles to the lines of cleavage." On the other hand, Mr Daniel Sharpe attempts to combine with this mechanical theory "the action of some peculiar crystalline force;" while Messrs Sorby and Tyndall adopt the purely mechanical view—the former maintaining that the flattish unequiaxed particles of the ancient mud and sand greatly aided the compressing force in producing cleavage; and the latter, that the result was unaided by the shape of the particles, but was caused by the extension under pressure of the minute interstices which must exist in even the most finely-levigated mudstones.—See METAMORPHISM.

Cleavelandite (after Professor Cleaveland).—One of the Felspar family, and known also as *albite*, but differs little either in form or composition from ordinary felspar or *orthoclase*.

Cleveland Ironstone.—An important ore of iron obtained from the Cleveland district in Yorkshire, where a stratum, 16 feet thick, of a rusty-looking sandstone (the "Lias Band") crops out from the middle of the Lias formation, and is considered to yield on an average about 30 per cent of iron. "It is chiefly," says Ansted, "a carbonate of the protoxide of iron, with about 30 per cent of impurity, consisting of silica, alumina, lime, and magnesia, and a little water. It is sometimes massive, and sometimes alternates with shaly bands, and is generally oolitic in structure. It extends over a district of some hundreds of square miles, thinning out to the south, and capped by sandy shales containing scattered nodules of ironstone. Upwards of a million of tons of ironstone are annually extracted from this deposit, chiefly near Middlesborough."

Clinker.—In Mineralogy, the black oxide of iron, readily obtained in scales and globules from red-hot iron while under the hammer of the blacksmith. In familiar language the term is applied to the slaggy ferruginous crusts that form on the bars of engine-furnaces, round the taps of iron-furnaces, and the like.

Clinkstone.—A flinty felspathic rock or hornstone, of a greyish-blue colour, having a tendency to divide into slabs, and ringing or "clinking" with a sort of metallic sound when struck by the hammer. Many so-called *clinkstones* are merely basaltic greenstones, having a shivery or fissile structure—the thin slabs ringing under the hammer.—Same as PHONOLITE.

Clionítes.—A genus of minute fossil sponges, or rather the silicified casts of these sponges, occurring in perforations of shells found in the Chalk formation. They are named after the existing parisitical sponge *cliona*, whose perforations often completely riddle the oyster and other shells.

Clunch.—An English provincial term for any tough coarse clay; applied to certain clays of the Coal-measures, and also to the hard clayey beds of the Gault or chalk-marl.

Clyménia (Gr. *clymenè*, a sea-nymph).—A genus of nautiloid shells peculiar to Devonian strata, in which upwards of forty species have been detected. In the clymenia, the septa of the chambers are simple or slightly lobed, and the siphuncle is internal, or on the inner side of the whorls; hence the occasional synonym, *Endosiphonites.*

Clypeástridæ (Lat. *clypeus*, a buckler).—A family of fossil sea-urchins occurring in the Chalk, and characterised by their oblong or rounded form; mouth somewhat angular, and furnished with well-developed teeth; outlet distant from the summit; tubercles mere granulations, and the spines proportionably small. The group is usually divided into the *Galeritidæ* (helmet-like) and the *Clypeidæ* (buckler-like).

Coal (Ger. *kohle;* Fr. *houille*).—In mineralogical systems the COALS constitute a limited, but very distinct and highly important family, which embraces such species as *graphite, anthracite, common coal, brown-coal* or *lignite*, and *peat.* Chemically, their chief constituent is carbon, in combination with varying proportions of hydrogen, oxygen, and nitrogen; and in all there exists a greater or less amount of earthy impurities, which being incombustible, remain, after burning, as ashes. From their composition, which only differs from vegetable or woody matter in the diminished amount of its gaseous and volatile elements; from their internal structure, which, for the most part, exhibits to the naked eye, and almost always to the microscope, abundance of vegetable tissue; and from their lithogical and other characteristics, there can be no doubt of their vegetable origin — whether occurring as peat and lignite, in which the ligneous structure is still apparent, or as common coal and anthracite, in which, for the most part, mineralisation is so perfect as to have obliterated every external trace of their organic origin. We have thus the most satisfactory evidence that COAL, in all its species, is merely mineralised vegetation—vegetation which, in part, grew and was submerged *in situ* as peat-mosses, cypress-swamps, jungles, and forest-growths, and in part was *drifted* by rivers into the seas of deposit, whose varied strata of sandstones, limestones, shales, mudstones, coals, and ironstone, now constitute our available Coal-Fields. Of course, as the operations of nature are uniform and incessant, we have Coals of all periods—graphites and anthracites of the Silurian and Devonian, bituminous coals of the Carboniferous and Jurassic, lignites of the Tertiary, and peats of the current epoch—the products differing in quality according to the amount of mineralisation and subsequent metamorphism to which they may have been subjected. The available coal of Great Britain is no doubt of *carboniferous* age, but many excellent coal-fields in India, America, and other countries, belong

to the Jurassic or Oolitic period, while anthracites and graphites may belong to any epoch, just as the original bituminous coal may have been subjected to heat and other metamorphic processes. Like all mixed rocks, common coal presents many varieties—and these, according to their structure, texture, and qualities, have received various names, as *caking coal,* which is soft or "tender" in the mass, like that of Newcastle, and swells and cakes together in burning; *splint* or *slate coal,* which burns free and open, and is hard and slaty in texture; *cannel,* which is compact and jet-like in texture, and burns with a clear candle-like flame, and, from its composition, is chiefly used in gas manufacture; and *coarse, foliated,* or *cubic coal,* which is more or less soft, breaks up into large fragments, and contains in general a large per-centage of earthy impurities. Between these there is, of course, every gradation—coals so pure as to leave only one or two per cent of ash, others so mixed as to yield from ten to thirty per cent, and many so impure as to be unfit for fuel, and so to pass into *shales* more or less bituminous. The following analysis exhibits proximately these gradations, but mainly that varying proportion of gaseous elements which marks the passage of wood into peat, peat into coal, and coal into anthracite and graphite :—

(*At* 212°.)	*Carbon.*	*Hydrogen.*	*Oxygen.*	*Nitrogen.*	*Inorganic Ash.*
Wood...........	48—54	6—10	35—45	...	...
Peat	56—66	5—9	18—33	2—4	1—6
Lignite	56—70	3—7	13—27	1—0	1—13
Coal	70—92	2—6	1—8	0—2	3—14
Anthracite ...	74—93	1—4	0—3	trace	1—7
Graphite	80—98	...	...	...	1—7

Cobált (Ger. *Kobalos,* the demon of German mines).—A metal discovered by Brandt in 1733. As an ore it is found chiefly in combination with arsenic as *arsenical cobalt* or *smaltine,* or with sulphur and arsenic as *grey cobalt ore.* As a metal it is white and brittle, unchanged in the air, has a high melting point, is strongly magnetic, and has a specific gravity of 8.5. It is seldom used in the metallic state, owing to the difficulty of reducing its ores, but these are extensively employed in the arts, as in the production of pigments, inks, stains, and glazes. The ores of cobalt (smaltine, sulphuret of cobalt, &c.) occur in granitic, crystalline, and secondary formations, in connection with ores of silver, copper, &c.; and being at first mysterious and intractable, received their name from the mysterious *Kobalos* who is supposed to obstruct the operations of the miners.

Cóccolite (Gr. *kokkos,* a berry, and *lithos*).—Granular sahlite; a variety or sub-species of augite occurring in granular or berry-like concretions; hence the name.

Coccósteus (Gr. *kokkos,* a berry, and *os,* a bone).—Literally "berry-bone;" a fish of the Old Red Sandstone, and so termed from the small, berry-like tubercles with which the plates of its cranial buckler and body are thickly studded. In general appearance *Coccosteus* resembles *Pterichthys,* but wants the arm-like appendages, and is usually much larger—ranging in the Caithness flagstones from a few inches to two feet in length. In both, the body-plates were similarly arranged and tuberculated; in both, the tail or terminal portion was covered with scales, and supported a fin or fins; and both seem to have possessed small bony teeth in either jaw. Hugh Miller and Dr Pander have attempted outlines, but the data are yet insufficient

for a satisfactory restoration. It is usual to arrange Coccosteus and Pterichthys under the family *Cephalaspidæ;* but the group is yet too little understood for this arrangement, and in the mean time all that can safely be done is to rank them as members of the great order of PLACODERMS or PLACOGANOIDS, in allusion to the bony plates which constitute their external covering or skeleton.

Cóchliodus (Gr. *cochlias,* a cockle, and *odous,* tooth).—Literally "cockle-like tooth;" a genus of Cestraciont fish-teeth occurring in the mountain limestone, and so termed from their cockle-shell-like aspect.

Cœlacánthi (Gr. *koilos,* hollow, and *acantha,* spine).—Literally "hollow-spines;" an extensive group of fossil sauroid fishes, that derive their name from the central cavity in their fin-rays, which, however, may have had originally cartilaginous cores. They occur from the Devonian to the Chalk inclusive, and embrace such genera as *cœlacanthus, asterolepis, dendrodus, holoptychius, rhizodus, macropoma,* &c.

Coélodont (Gr. *koilos,* hollow, and *odous,* tooth).—Literally "hollow-toothed;" a term applied to those lacertilians or lizard-like reptiles which have hollow teeth, in contradistinction to the *Pleodont* or solid-toothed.

Cœlorhýnchus (Gr. *koilos,* hollow, and *rhynchos,* beak).—Literally "hollow-beak;" a genus of sword-fishes whose prolonged premaxillary bones or "swords" have been found in the upper chalk and eocene tertiaries of England.

Cœnoécium (Gr. *koinos,* common, and *oikos,* dwelling).—The term employed by Professor Allman to designate the plant-like structure or common dermal system of the polyzoa, in contradistinction to the *polypary* or *polypidom* of the true polypes.

Coke.—Charcoal; the carbonaceous residue of coal after the volatile matters have been driven off by heat. Formerly coke was prepared by a smothered combustion of the coal in open-air heaps; now it is prepared in ovens specially constructed for the purpose.

Coleóptera (Gr. *koleos,* a sheath or case, and *pteron,* wing).—Sheath-winged; an order of insects, like the beetles, furnished with hard crustaceous sheaths (*elytra*) which cover and protect their membraneous wings or organs of flight. Coleopterous insects are found fossil from the Coal-formation upwards.

Collywéston Slates.—Also known as "Collyweston Tilestones;" a subordinate series of laminated calcareous beds occurring at Collyweston, near Stamford, in Lincolnshire; and from their position supposed to be the equivalents of the celebrated "Stonesfield Slate."

Cologne Earth.—An earthy, peaty mass of lignite, or partially fossilised wood, occurring in an irregular bed of from 30 to 50 feet thick, near Cologne, Lower Rhine.

Cololítes (Gr. *colon* and *lithos*).—A name given to certain tortuous and convoluted intestinal-like masses and impressions which appear in some instances to be either the petrified intestines of fishes, or the contents of their intestines, still retaining the forms of the tortuous tube in which they were lodged,—hence the name; but which in the majority of cases are undoubted worm-casts, like those of the lob-worm.

Colóssochélys (Gr. *kolossos,* a statue of enormous size, and *chelys,* a tortoise.)—The generic term given by Dr Falconer to the bones and portions of the carapace of a tortoise of gigantic dimensions, discovered by him and

Captain Cautley in the upper tertiaries of the Siwalik hills in India. The remains discovered indicate a length of twelve or fourteen feet.

Colour of Minerals.—In describing rocks and minerals, their colours are usually mentioned as a simple and obvious aid to identification. Mineralogists divide these into the *metallic* and *non-metallic*,—the latter embracing the ordinary colours, as *black*, *white*, *red*, *green*, &c.; or combinations of them, as *yellowish-white*, *reddish-brown*, *blackish-green*, and the like; or peculiar hues taken from familiar objects, as *chestnut-brown*, *olive-green*, *sky-blue*, and so forth. The metallic colours, on the other hand, are less numerous, and much more decided and peculiar; hence we have *copper-red*, the colour of native copper; *bronze-yellow*, as iron-pyrites; *brass-yellow*, copper-pyrites; *gold-yellow; silver-white; tin-white; lead-grey*, as galena; *steel-grey; iron-black*, as specular iron-ore; and a few other shades equally distinct and decided.

Colúmnar (Lat. *columna*, a column).—Having the form of columns; arranged in columns. The basalts of Staffa and the Giant's Causeway are said to be *columnar*, because composed of column-like masses less or more regular in form and arrangement. When the form and arrangement of these masses are indistinct and irregular the structure is said to be *sub-columnar*.

Combe or Coomb (Sax.)—A common term in the South of England for an upland valley, generally narrow, and without a stream of water. Dr Buckland remarks, "The term *combe* is usually applied to that unwatered portion of a valley which forms its continuation beyond and above the most elevated spring that issues into it; at this point or spring-head the *valley* ends and the *combe* begins."

Combustion (Lat. *con*, together, and *uro*, I burn).—Consumption by fire; the act of burning. In Chemistry, this term is generally applied to the phenomena exhibited by burning bodies, and which depend upon the rapid union of the *combustible* with the oxygen of the air. The heat and light which accompany ordinary combustion, announce intense chemical action; and the consequence is that combustion is always attended by the production of new compounds.—**Combustible,** susceptible of being burnt; having the property of catching fire. In Mineralogy, the combustible or inflammable minerals are—sulphur, diamond, the coals, bitumens, mineral resins, and the inflammable salts.

Cómminute (Lat. *con*, and *minuo*, I lessen).—To reduce to small fragments.—**Comminuted**, reduced to small fragments, like the broken shells (shell-sand) of the sea-shore.

Cómptonite.—Known also as *Thomsonite*, after the well-known chemist; one of the Zeolite family, occurring with calc-spar and other zoolitic minerals in cavities, in trap-rocks, and in old lavas. Named after Lord Compton, who brought it from Vesuvius in 1818.

Conchífera (*conchè*, Gr. a shell, and *fero*, I bear).—An extensive class of acephalous bivalve mollusca, including the oysters, scallops, mussels, and cockles. The conchifera are mostly equivalve, and are usually divided into two orders—the *Monomyaria*, or those having only *one* muscular impression on the valve; and the *Dimyaria*, or those having *two* muscular impressions, and consequently furnished with two adductors.—See tabulations, "Animal Scheme."

Conchóidal (Gr. *conchè*, and *eidos*, form).—Shell-like; applied to that peculiar *fracture* of rocks and minerals which exhibits concave and convex

surfaces resembling shells; thus, when we chip a piece of flint or cannel-coal, the newly-exposed surface exhibits the *conchoidal* fracture.

Cóncrete (Lat. *con*, together, and *cretus*, grown).—A compact mass, composed of coarse pebbles and sand, run or cemented together by lime. Concrete is employed in the foundations of buildings, as a groundwork for causewaying, and occasionally as an artificial stone or pavement. About 60 parts of pebbles, 25 of river sand, and 15 of lime, form a good concrete.

Concrétion, Concretionary (Lat. *con*, and *cretus*, grown together).—Nodules like those of chert and ironstone, the grains and spherules of oolite, and the grape-like clusters of the magnesian limestone, are termed "concretions," as formed by a molecular aggregation distinct from *crystallisation*. The *concretionary structure* is very apparent in certain deposits from calcareous springs (*e.g.*, the pisolite of Carlsbad), in many greenstones, and in other rocks both of ancient and recent formation.

Confervítes.—Fossil plants, apparently allied to the aquatic confervæ; occurring chiefly in the Chalk formation.

Confluence (Lat. *con*, and *fluo*, I flow).—The point at which two or more streams meet; the junction of a tributary stream with the main river.

Conformable.—Strata or groups of strata lying one above another in parallel order are said to be *conformable;* when not in the same plane, or not dipping at the same angle, with those on which they are deposited, they are termed *unconformable*, which see.

Congéners.—Applied in natural history to plants and animals that belong to the same genus.

Conglómerate (Lat. *con*, together, and *glomerare*, to gather in round heaps).—Rocks composed of consolidated gravels, just as sandstones are composed of consolidated sands; known also as *puddingstones*, from the resemblance of the pebbles in the mass to the fruit in a plum-pudding. In *breccias* the fragments are more or less angular; in *conglomerates* they are rounded and water-worn, and may vary from pebbles the size of a pea to boulders half a ton in weight.—See PUDDINGSTONE.

Coníferæ, Coniferous.—Cone-bearing; applied to the pine tribe, whose seeds occur in cones, as the larch, pine, &c. The order includes the firs, pines, yews, junipers, &c., some of which have berry-shaped rather than scaly-coned fruit; but in all the family resemblance, habit, and woody structure are greatly alike. Structurally considered, the *conifers* stand intermediate between the *endogens* and *exogens*, forming the *gymnogens* or *gymnosperms* of the botanist. Undoubted coniferous wood makes its first appearance in the carboniferous system, and continues upwards throughout all the subsequent formations.—See tabulations, "Vegetable Scheme."

Cónodonts.—Literally "cone-teeth;" minute, glistening, slender, conical bodies, hollow at the base, pointed at the end, more or less bent, with sharp opposite margins, and occurring in thousands in the Lower Silurian schists of Russia. They are supposed by Pander to be the horny teeth of cartilaginous fishes; but this view is opposed by Huxley, Owen, and other naturalists, who regard them as more likely to be the "spines or hooklets or denticles of naked molluscs and annelids"—an opinion which has many geological coincidences to support it.

Contemporáneous (Lat. *con*, together, and *tempus, temporis*, time).—Existing at the same period; formed during, or belonging to, the same geological epoch.—**Contemporanéity**, the state of being contemporaneous with;

hence we speak of lines and strata of contemporaneity in widely separated portions of the same system.

Contorted (Lat. *con*, together, and *torsus*, twisted).—Applied to strata which, like gneiss and mica-schist, exhibit frequent irregular bendings and flexures, as if they had been crumpled and twisted while in a soft and yielding condition.

Conulária (Lat. *conulus*, a little cone).—A genus of Pteropod shells, so called from their tapering conical outline. Conularia is four-sided, straight, tapering, the angles grooved, and the sides striated transversely, as if the thin shell had been divided by numerous septa. Several species are found in the Silurian, Devonian, and Carboniferous formations.

Cophínus (Gr. *kophīnos*, a basket).—A term applied to curious organic markings, as yet detected only in silurian shales, but common, in all probability, to all palæozoic and mesozoic mudstones. Their shape is inversely pyramidal, more or less circular and upright, and having the sides scored with elegant transverse grooves resembling fine wicker-work, whence the name. They are supposed to be impressions made by the stems of encrinites, which, rooted and half-buried in the micaceous mud, have produced, by their wavy and somewhat rotatory motion, the beautiful pattern, every line of which answers to one of the projecting rings of the jointed stem. The funnel-shaped hollow produced in wet soil by the waving of a flower-stem in a windy day is an analogous phenomenon.

Copper (Lat. *cuprum*, a corruption of *Cyprium*, from the island of Cyprus, whence it was anciently brought).—One of the most abundant and earliest known metals, being the chief ingredient in domestic utensils and implements of war before the use of iron. It occurs *native* in the metamorphic and igneous rocks in threads, strings, and arborescent incrustations; in plates and laminæ; also investing, massive, and disseminated; but rarely in loose grains or lumps. Occasionally it is found deposited in mines from water containing the sulphate, after the manner of the electrotype process; and not unfrequently large anomalous masses, weighing from 1600 to 4000 lb. (like those of Lake Superior and South America), are found in the igneous rocks. More frequently and more abundantly it occurs as an *ore* in many formations—the yellow copper-ores (pyrites), the grey copper-ores, the red copper-ores, and some of the copper salts, being the most important and valuable. As a metal it is distinguished by its peculiar red ("copper-red") colour; has a hardness of from 2.5 to 3.; specific gravity, from 8.5 to 8.9; is malleable and ductile; and requires a temperature of nearly 2000° Fahr., or that of white heat, to fuse it. It is readily acted on by acids, which form with it blue or green salts; and as these are poisonous, hence the necessity of care in the use of copper utensils for culinary and domestic purposes. It is readily detected in solution by the bright blue produced by the addition of liquid ammonia—by the brown precipitate formed by the ferrocyanate of potash—or by its speedily coating a slip of polished iron or steel (a knife-blade, for example) with a thin film of metallic copper. Copper is largely employed in the arts and industry of all civilised nations, either alone or as an alloy—bronze, brass, bell-metal and gun-metal being some of its most important admixtures.

Cópperas (Ger. *kupfer-wasser*).—The familiar term for sulphate of iron. The sulphate of copper occurs in blue, and the sulphate of iron in green crystals; hence apparently the term *copperas*. It is prepared by moistening the pyritous shales (sulphurets of iron) which are found abundantly in

the coal-measures, &c., and exposing them to the air, when decomposition takes place and the sulphuret is converted into the sulphate of iron, which is subsequently dissolved and evaporated, to procure it in the crystallised state.

Copper-Nickel.—Known also as *nickeline;* a native arseniuret of nickel generally occurring in veins in the crystalline and transition rocks, associated with cobalt, silver, and other ores. It derives its name from its light copper-red colour, and is used as an ore of nickel in the manufacture of German silver.

Cóprolite (Gr. *kopros,* dung, and *lithos,* stone).—Petrified excrements or dungstone. Coprolites are found in all the secondary and tertiary strata, and appear to be the voidings chiefly of saurians and sauroid fishes. In many instances they contain fragments of scales, shells, &c., the undigested portions of the prey of these voracious creatures. Many specimens exhibit on their surfaces the corrugations and vascular impressions of the intestines; and masses of coprolites have been detected *in situ* within the ribs of liassic ichthyosauri. Coprolites are found in greatest perfection studding the surfaces of certain argillo-calcareous shales in the lias and coal-measures; enclosed as the central nucleus of nodules and balls of ironstone in the coal-measures; and in those phosphatic nodules of the greensand and lower chalk now used for manurial purposes.

Coral (Gr. *korallion*).—The comprehensive term for all calcareous or stony structures secreted by the marine asteroid polypes, or zoophytes. *Coralloid,* having the appearance or structure of coral; *coralline,* partaking of the nature of coral.

Coral Rag.—The upper member of the middle oolite, so called because it consists, in part, of continuous beds of petrified corals, for the most part retaining the position in which they grew, and sometimes forming masses 15 feet thick.—See OOLITE.

Coral Reef.—The term applied by naturalists, as well as by mariners, to any connected mass of coral structures, whether trending away in long partially-submerged ledges, encircling islands like breakwater-barriers, or rising as low ring-shaped islets above the waters of the ocean. Such masses are found studding the Pacific on both sides of the equator to the thirtieth degree of latitude; abounding in the southern part of the Indian Ocean; trending for hundreds of miles along the north-east coast of Australia; and occurring less or more plentifully, in patches, in the Persian, Arabian, Red, and Mediterranean seas. In the Pacific, where volcanic agency is actively upheaving and submerging, coral-reefs are found forming low circular islands, enclosing lagoons (*atolls* or *lagoon islands*); surrounding islands of igneous and other origin (*fringing* or *shore reefs*); crowning others already upheaved (*coral-ledges*); or stretching along shore in surf-beaten ridges (*the true barrier or encircling reef*) of many leagues in length, and from 20 to more than 200 feet in thickness. Regarding them as mainly composed of coral, and knowing that the zoophytes can add, unless in some very favourable situations, only a foot or two to the structure during a century, many of these reefs must have been commenced before the dawn of the present epoch; and looking upon them as consisting essentially of carbonate of lime, we have calcareous accumulations now in progress rivalling in magnitude the limestones of the secondary formations.

The composition and construction of coral reefs, though effected chiefly by lime-secreting zoophytes, seem owing in some measure to the promiscuous aggregation of marine debris. The more abundant reef-builders,

according to Darwin, are the *madrepores, astræas, porites, meandrinæ,* and *nullipores,* at moderate depths, and the *millepores, seriatopores,* and other delicate forms, at depths from fifteen to twenty fathoms—the great field of coral development thus lying between low water and twenty fathoms. As produced by these minute workers, coral is almost a pure carbonate of lime, soft and porous at first, but gradually becoming so hard and compact as to be used in the South Sea Islands for building. During its formation, however, it encloses shells, fragments of drift-coral, sea-weeds, sponges, star-fishes, sea-urchins, drift-wood, and the like; and these being cemented in one mass by the growth of new coral, the drift of coral-sand, and the infiltration of carbonate of lime from decomposed coral, the rock presents a brecciated appearance extremely analogous to some older limestones. Again, the sediment deposited in the lagoons and sheltered water-channels, and which arises from the raspings and droppings of the animals which bore into or browse upon it, produces, when dried and consolidated, a substance scarcely distinguishable from some earthy varieties of chalk. Further, where reefs have been upheaved by subterranean agency, as the strata of fossil coral on the hills of Tahiti, or enveloped in volcanic tufas, as in the Isle of France, where a bed ten feet thick occurs between two lava currents, the "coral-stone" has a sparry crystalline aspect—thus presenting the geologist with almost every gradation of limestone, from the soft chalky mass of yesterday's secretion to the compact texture of saccharoid marble. On the subject of corals and coral-reefs, the reader may consult Darwin *On the Structure and Distribution of Coral Reefs;* Dana in the *Report on the Geology of the United States' Exploring Expedition;* Stutchbury in the *West of England Journal;* Beechy in his *Voyage to the Pacific;* and other recent voyagers.

Coral Zone.—In marine zoology, the coral zone, as its name implies, is the region of the calcareous and stronger corals, and extends from 300 to 600 feet—a depth rarely found in true British seas, but where found, characterised by forms of star-fish, cidaris, and brachiopod mollusca, which cannot exist in shallower waters.

Coralline Zone.—That zone of marine life which extends from 90 to about 300 feet in depth, and is, in our latitudes, the great theatre of marine life: the common sea-weeds cease, and corallines luxuriate; the ordinary shore-shells disappear, and buccinum, fusus, trochus, venus, pecten, and the like, abound.

Corax (Gr., a kind of shark-fish).—A genus of shark teeth occurring in the Chalk formation, and differing chiefly from those of the recent genus *Galeus,* to which the *Tope* or Grey Shark belongs, in being solid. They are of small size, of triangular form, with a deep concavity on the posterior margin, the base of which is prolonged, and forms three or four angular points, and have the anterior edge finely serrated. The root of the tooth, as in *Notidanus,* is a broad bony plate.

Coriáceous (Lat. *coríum,* a hide).—Having a tough leathery consistence; having the texture of rough skin. Applied to many vegetable and animal substances.

Cornbrash.—A provincial term, used by Smith, for a coarse shelly limestone of the Upper Oolite. It is said to derive its name from the facility with which it disintegrates and breaks up (*brashy*) for the purposes of corn-land.—See OOLITIC SYSTEM.

Corncockle Muir, in Dumfriesshire, celebrated for the fossil footprints

which occur on the slabs of its Permian sandstones, and which form the subject of Sir W. Jardine's monograph, *The Ichnology of Annandale.*

Córnean (Lat. *cornu,* a horn).—An igneous rock, so called from its tough, compact, and horn-like texture; known also as *Aphanite,* which see.

Córneous (Lat. *cornu,* a horn.)—Horny; having the colour and texture of horn; *e.g.* the operculum and dried epidermis of many shells, the carapace of the turtle, &c.

Cornstone.—A term usually applied to the reddish and bluish-red concretionary limestones which occur in the middle formation of the Old Red Sandstone. In Hereford, Fife, and Forfar, they occur associated with reddish marls and sandstones; are often irregular in their stratification; are frequently too siliceous to be used as limestones; and are altogether void of fossils. They are said to derive their name from the fertile corn-soil that overlies them in Hereford, as compared with the tenacious clays which cover the marls and sandstones.

Cornu A'mmonis (Lat. *cornu,* a horn).—An obsolete term for the ammonite, from its fancied resemblance to the horn with which the head of Jupiter Ammon was sculptured.

Cornulítes (Lat. *cornu,* a horn).—A genus of ringed or annulated shelly tubes occurring in Silurian strata, and so called from their shape. At one time supposed to be tentacles or encrinal stems, they are now regarded as the shelly tubes of marine annelids.—See TENTACULITES.

Corroded (Lat. *corrodo,* I eat or wear away).—Eaten away by degrees; worn away as limestone is by the carbonic acid and moisture of the atmosphere. *Corrosion,* the act or state of being so worn away; and *corrosive,* having the power of dissolving and gradually wearing away.

Corrugated (Lat. *con,* together, *ruga,* a wrinkle).—Wrinkled; covered with irregular folds; having a crumpled and uneven surface.

Corýphodon (Gr. *koryphê,* a point, and *odous,* tooth).—A sub-genus of Lophiodont tapir-like pachyderms found in the eocene and miocene tertiaries of France and England; and so termed by Owen because the angles of the ridges of its molar teeth are developed into points. The broad, ridged, and pointed grinding surface of the tooth indicates its adaptation to comminute the coarser kinds of vegetable substances.

Cósmical (Gr. *kosmos,* order, natural order as that of the universe).—Relating to the world or universe, as cosmical laws, or laws of the universe.

Cosmógony (Gr. *kosmos,* world, and *gonê,* origin).—Reasoning or speculation as to the origin or creation of the universe. Distinct from Geology, whose object is to unfold the *history* of our globe as far only as fact and observation will permit of sound deduction.

Cosmógraphy (Gr. *kosmos,* and *grapho,* I write).—The science which treats of the several parts of the world, their laws and relations.

Cosmólogy (Gr. *kosmos,* and *logos,* reasoning).—The science that treats of the laws that govern the physical universe; the study of the world in general.

Cósmos (Gr. *kosmos*).—Literally "order;" natural order like that prevailing in the universe. The whole framework of the material universe; the world, from the orderly arrangement and symmetry of its component parts in contradistinction to *chaos*—the confused and disorderly mass from which it arose.

Coulées (Fr. *couler*, to flow as melted metal).—In frequent use by geologists for *streams* of lava, whether in the act of flowing or long since consolidated into rock-material.

Courses.—Applied in geology to thin regular strata from their being superimposed upon one another like the hewn "courses" of a building; hence we hear such phrases as "alternate courses of limestone and shale."

Crag (Celt. *creggan*, shell).—Shelly tertiary deposits of the Pliocene epoch, occurring in Norfolk and Suffolk, and generally subdivided into three members—viz. the upper or "Mammaliferous Crag," the "Red Crag," and the lower or "Coralline Crag."—See TERTIARY SYSTEM.

Crag and Tail (properly "craig and tail").—Applied to a form of secondary hills common in Britain, where a bold precipitous front is exposed to the west or north-west, and a sloping declivity towards the east. The phenomenon of crag and tail is evidently the result of the currents of the "Drift" epoch, which in our latitude swept from north-west to north-east, laying bare the opposing heights, but leaving untouched the sheltered slopes and terraces.

Craigleith Stone.—A compact, fine-grained, free-dressing, whitish-grey sandstone quarried at Craigleith, near Edinburgh, and largely used in the Scotch metropolis as a building-stone. It is almost entirely composed of siliceous sand; the purer beds containing about 98 per cent of silica—the admixtures being carbonate of lime, alumina, and iron.

Crânia (Gr. *kranos*, a helmet or head-piece).—A genus of small brachiopodous molluscs, which attach themselves to other bodies, and consequently have the lower valve flat, and the upper limpet-like or helmet-shaped. They occur from the Lower Silurian to the Chalk inclusive.

Crater (Gr. *krater*, a cup or bowl).—The mouth or orifice of a volcano; so called from its cup or bowl shape. Craters may be central or lateral in the mountain in which they occur; there may be one principal and several subsidiary ones; and they may shift their places and become absorbed by subsidence, or be obliterated by eruptions from more active orifices. The craters of active volcanoes have in general one side a little lower, owing to the prevailing winds carrying the greater portion of the light material (scoriæ and ashes) to the opposite side.—See VOLCANO.

Creep.—A miner's term for the depression that takes place at the surface of the earth when coal or other mineral has been removed from below, and the whole superincumbent strata thus gradually sink or *creep* down in consequence of their support having been taken away.

Cretáceous or Chalk System (Lat. *creta*, chalk).—The Cretaceous system—so called from the chalk beds which form its most notable feature—is the last or uppermost of the secondary formations. As typically developed in the south of England, it is composed of calcareous, argillaceous, and arenaceous rocks—the former predominating in the upper, and the two latter in the lower portion of the system. The calcareous members are generally known as "chalk" and "chalk-marls,"—the former being applied to the purer beds, and the latter to those that are more earthy and clayey; the argillaceous strata, which are for the most part stiff blue marly clays, are known by the provincial term "gault" or "golt;" and the sandy beds, being frequently coloured green by the presence of chloritic matter, are distinguished as "greensands." The nodular masses of "flint" that occur in the chalk consist almost of pure silex, more or less coloured by iron; and the impure calcareo-siliceous nodules and concretions are spoken of as

"chert." The system, as occurring in the south of England, is usually grouped as follows :—

CHALK.	UPPER CHALK.—Generally soft white chalk, containing numerous flint and chert nodules more or less arranged in layers.
	LOWER CHALK.—Harder and less white than the upper, and generally with fewer flints. (Reddish in the north of England, and with abundance of flints.)
	CHALK MARL. — A greyish earthy or yellowish marly chalk, sometimes indurated.

GREENSAND.	UPPER GREENSAND.—Beds of siliceous sand, occasionally indurated to chalky or cherty sandstone (the "fire-stone" of Surrey), of a green or greyish white, with nodules of chert.
	GAULT.—A provincial name for a bluish tenacious clay, sometimes marly, with indurated argillaceous concretions and layers of greensand.
	LOWER GREENSAND.—Beds of green or ferruginous sands, with layers of chert and indurated sandstones, local beds of gault, rocks of chalky or cherty limestone (Kentish rag), and fuller's earth.

Or, adopting the recent views of palæontologists respecting the cretaceous affinities of the Wealden, and adding certain Continental beds which are wanting in England, we have then an Upper and a Lower group, comprising the following subdivisions :—

UPPER CRETACEOUS.

1. Maestricht beds and Faxoe limestones.
2. White chalk, with flints.
3. Chalk marl, or grey chalk slightly argillaceous.
4. Upper greensand, occasionally with beds of chert, and with chloritic marl (craie chloritée of French authors) in the upper portion.
5. Gault, including the Blackdown beds.

LOWER CRETACEOUS (*Neocomian.*)

1. Lower greensand—Greensand, ironsand, clay, and occasional beds of limestone (Kentish rag).
2. Wealden beds—or Weald clay and Hastings sands.

Whichever view is adopted, the entire suite of strata—with the exception of the fluvio-marine beds of the Weald—bear evidence of shallow and widespread seas, and of a climate favourable to the growth of cycads and zamias on land, and of corals, gigantic saurians, and turtles in the waters. Palæontologically, the remains of the chalk and greensand are eminently marine, and comprise numerous species of sponges, corals, star-fishes, sea-urchins, shell-fish, crustacea, fishes, and reptiles. Indications of bird and mammalian remains have also been detected, but these are as yet too scanty and obscure to warrant any definite conclusion. On the whole, all the Life-types of the system are strictly Mesozoic, and of the numerous species found in the Trias, Oolite, and Chalk, not one, it is affirmed by palæontologists, have been detected in Tertiary strata.

Industrially, the chief products of the system are chalk and flint.

Chalk, as an almost pure carbonate of lime, is calcined like ordinary limestones, and employed by the bricklayer, plasterer, cement-maker, and farmer; and levigated, it furnishes the well-known "whiting" of the painter. Flint calcined and ground is used in the manufacture of china, porcelain, and flint-glass; and before the invention of percussion-caps was in universal use for gun-flints. In the south of England flints are extensively used as road-material; and the larger nodules are frequently taken for the building of walls and fences. Beds of fuller's earth are worked in the greensands, whose indurated strata likewise furnish supplies of not indifferent building-stone and road-material. From the Gault and Upper Greensand of Farnham in Surrey are also obtained those phosphatic nodules, now used as a manure by being ground to powder and converted into the superphosphate by the action of sulphuric acid; as well as that "firestone rock" which is said to contain from 30 to 70 per cent of silica soluble in alkalies, and employed in like manner for manurial purposes.

Crinoids, Crinoidea (Gr. *krinon*, a lily, and *eidos*, likeness).—Literally, "Lily-like animals;" the Encrinites; an extensive order chiefly of fossil Echinoderms, so termed from the resemblance which their rayed bodies, surmounted on long slender stalks, have, when closed, to a tulip or lily. In existing seas the Crinoids are represented by the *Comatulæ* or "featherstars" of our own shores, and by the rare and all but extinct *Pentacrinites* of the West Indies. The Comatula, though free floating in its adult state, is attached by a stalk when young; the marsupite, a fossil form, appears also to have been free in its mature state; but all the other families were fixed to the sea-bottom or to other objects by their long, slender, many-jointed stems. The characteristics of the order, which is of vast geological interest, is well exemplified in the *Pentacrinus*, specimens of which are in the British Museum, the College of Surgeons Museum, London, and in the Hunterian Museum, Glasgow. This animal has a long stem or column, which is composed of calcareous joints or ossicles, articulated to each other by radiated surfaces, and is fixed by the base to a rock or other firm body. The stem, which gives off a number of slender side-branches, supports a vasiform receptacle or cup, formed of five calcareous plates in close apposition; and in this receptacle the digestive and other viscera are situated. The upper part of the receptacle is covered by a plated integument, in which there is an aperture for the mouth. From the margin or brim of the receptacle, or pelvis as it is sometimes termed, proceed ten many-rayed arms, which subdivide into branches of extreme tenuity. On the upper and inner side of the arms are numerous articulated feelers or pinnæ capable of expansion and contraction, for the capture of prey. In fact, the pentacrinite may be described, without much error, as a stalked comatula, and this designation of "stalked star-fishes" is more or less appropriate to the entire order of Encrinites. The innumerable calcareous joints which constitute the skeleton of the pentacrinite are held in vital union partly by a fleshy investing integument, and partly by the central perforation which connects the stalk and all the other members with the receptacle containing the viscera or body of the animal. Such is the Pentacrinus, and such, in general terms, is the whole of the order—the main differences lying in the stems, which are round and smooth in the *Encrinites* proper, and pentagonal and ornamented in the *Pentacrinites;* some having the stem simple, others branched; some having the joints equal and similar, others having them large and small alternately; some having

the plates of the receptacle larger and more numerous than others; some having the arms in few bifurcations, others having them in many branches, and armed with innumerable feelers. On these and similar distinctions are founded such families as the *apiocrinites* or pear-encrinites, the *cyathocrinites* or cup-encrinites, and others which appear in the usual subdivisions of the Order.—See ENCRINITES.

Geologically, the Encrinites range from the Silurian up to the present epoch—most abundantly in palæozoic and mesozoic strata, rarely in cainozoic, and now represented only by *comatula*, and the all but extinct *pentacrinus*. Like the corals, their function seems to have been, to a great extent, the secretion of lime from the ocean—whole strata of limestone, Silurian and Carboniferous, being almost entirely made up of their remains. As in other life-forms, each epoch has had its own peculiar genera and species, and thus we rise from the *platycrinites, poteriocrinites, cyathocrinites*, and *actinocrinites* of the palæozoic formations, to the *pentacrinites, apiocrinites*, and *marsupites* of the mesozoic, as certainly as we pass from these to the *comatula* of existing seas.—See tabulations, "Animal Scheme."

Crióceras, Criocératite (Gr. *krios*, a ram, and *keras*, horn).—A genus of the Ammonite family peculiar to the gault and greensand, and so named from its shape, the whorls being separate, like the coils of a ram's horn.

Crocodília.—A well-known group or order of reptiles represented by the crocodiles, gavials, and alligators of existing rivers. They have their body supported on four partially webbed feet, and encased in an armour of bony plates or scutes, hence they are said to be *loricated* or mailed. Crocodilians occur fossil from the Lias upwards; but those occurring up to the Chalk inclusive differ from existing genera in the character of their vertebræ, which are either doubly flat, doubly concave (*amphicœlian*), or convex before and concave behind (*platycœlian*); while in recent species, and in those occurring in tertiary strata, the vertebræ are concave in front and convex behind (*procœlian*). Besides these differences, the genera having broad muzzles, like the cayman and alligator, are unknown below the tertiary formations—all the secondary genera being referable to the division having elongated beaks, like the recent gavial. *Crocodilus, alligator*, and *gavialis*, are recent and tertiary genera; *goniopholis, teleosaurus, steneosaurus*, &c., are those found in the Chalk and oolitic formations.

Crop.—The edge of any inclined stratum when it comes to the surface is called the *crop* or *outcrop*, which see.

Cross-Course.—A miner's term for a vein or lode which intersects at right angles (literally *crosses*) the general direction of productive metalliferous veins in any mining district.

Cross-Cut.—In mining, a level driven at right angles to the known direction of a lode with a view to intersect it.

Crotalocrínus (Gr. *krotalon*, a child's rattle).—An upper Silurian encrinite, so called from its very peculiar shape and structure. In most encrinites, the arms issue immediately from the edge of the pelvic cup, commencing with a single joint and soon branching into two, three, or four; the subdivisions varying in different species. But in this genus the subdivisions commence at the very edge of the cup, and become so numerous as to form a perfect network—the five primary reticulate arms overlapping each other, and forming, as it were, a convoluted funnel-shaped organism of the finest basket-work, instead of the rayed arrangement of the common encrinite. The stem was made up of close tuberculated

joints—each tubercle near the root lengthening into tubular processes for attachment to shells and corals.

Crustácea (Lat. *crusta*, a hard covering or crust).—Literally "Crust-clad;" an extensive and varied class of the Articulata or Jointed animals, comprising such well-known forms as the crab, crayfish, lobster, shrimp, and prawn. In very general terms they may be described as free animals, having articulated or segmented bodies, jointed limbs, a branchial or gill respiration, a double or complete circulation of blood, which is colourless, a nervous system consisting of chains of ganglions more or less numerous, the sexes distinct, and reproduction by ova or eggs. In many families the *crust* or covering, to which the class owes its name, is tough and flexible, and has for its base the peculiar substance termed *chitine;* in others it is hard and stony, and consists mainly of carbonate of lime. Such crusts being incapable of expansion so as to accommodate themselves to the increasing size of the animals, they are *moulted* or cast-off at stated periods, and this very frequently during the younger stages—a circumstance which accounts for the infinite numbers of the exuviæ of certain families in the deposits of lakes and estuaries. According to physiologists, the normal number of segments in the Crustacea is twenty-one—seven for the head, seven for the thorax, and seven for the abdomen; but most frequently several of the anterior segments are fused or soldered into a single piece termed the *cephalo-thorax*, leaving the *abdomen* or *post-abdomen* free, and terminated by a variously compounded tail-plate, *telson* or *pygidium*. It is this interfusion of parts which renders the forms of the Crustacean families so varied; and the metamorphoses which many of them undergo, from the larval to the adult stage, that render them so difficult of discrimination. This difficulty is further increased by their great variety of habitat—some living in the ocean, others in lakes and estuaries; some chiefly on land, others partly in trees; some inhabiting the shells and coverings of other animals, and others being parasitic, either for a portion or for the whole of their existence. Their function is also as varied as their habitats—most of them being carnivorous, many of them phytophagous, a large portion omnivorous, while the whole class act less or more as scavengers in clearing away dead and decaying matter.

For these reasons the classification and arrangement of the Crustacea by different systematists differ according to the point of view from which they have been studied. Thus they are often primarily subdivided into ENTOMOSTRACA (within shells) and MALACOSTRACA (soft shells)—the former embracing those small forms (cypris, nebalia, &c.) which are often partially or wholly enclosed in a bivalvular shell-like carapace; and the latter the larger forms (crayfish, lobster, &c.), originally termed "soft-shells," in comparison with the true testacea or shell-fish. Again, viewing them in reference to their organs of motion, we have such orders as *Copepoda* (oar-footed), *Phyllopoda* (leaf-footed), *Pœcilopoda* (various-footed), and the like, according as these members are more especially fitted for swimming, walking, or prehension. Farther, looking at the position of the eyes in the Malacostraca, we have *Podophthalmia* (stalk-eyed), and *Edriophthalmia* (sessile-eyed); at their limbs, and we have *Decapoda* (ten-footed), *Isopoda* (equal-footed), and so forth; or at their caudal terminations, and we have *Macrura* (long-tailed), like the lobster, *Brachyura* (short-tailed), like the crab, and *Anomura* (tail-less), like the hermit-crab. These and similar subdivisions show at once the multiplicity and complexity of form in the

class—a complexity which is greatly increased by the discovery of widely-divergent fossil forms for which new subdivisions and families have had to be erected.

Geologically, the Crustacea are of prime interest and importance. They occur in the oldest as well as in the most recent formations; the extinct forms have greatly enlarged our conceptions of vitality; and their occurrence in particular strata, and often in inconceivable numbers, enables us to reason on their uniformity of function, even when their forms and organisation appear to be altogether different. The more ancient forms —*trilobites* and *eurypterites*—have now no representatives, and resemble rather the larval than the adult form of any existing genus; in the Mesozoic forms—*glyphæa*, &c.—we catch a glimpse of the existing long-tailed decapods; and not till we ascend to upper Mesozoic and Cainozoic strata do we discover the more concentrated structures of the short-tailed crabs and their congeners.—For structural and systematic arrangements, see tabulations, "Animal Scheme."

Crýolite (Gr. *kruos*, hoar-frost, and *lithos*).—The double hydrofluate of soda and alumina, a rare mineral found only in veins in the Gneiss of West Greenland. There are two varieties, the snow-white and the rusty-yellow; and both are now used as the commercial ore of *aluminium.* Cryolite melts like ice in the flame of a candle; hence the name.

Cryptogámia, Cryptogamic (Gr. *kryptos*, concealed, and *gamos*, nuptials). —Literally flowerless; one of the great divisions of the vegetable kingdom, comprising the mushrooms, lichens, mosses, sea-weeds, and ferns, in which the organs of fructification are concealed or not apparent, as in the *Phanerogamia* or flowering plants. They are also termed *agamous, acotyledonous*, and *cellular plants.* Fossil in all formations.—See tabulations, "Vegetable Scheme."

Crystal (Gr. *krystallos*, ice).—Originally applied to transparent gems, but now extended to all minerals having regular geometrical forms. *Crystallised*, having the structure of a crystal, as rock-crystal; *crystalline*, confusedly crystalline, as granite; and *sub-crystalline*, indistinctly or faintly crystalline, as some varieties of limestone.—See CRYSTALLOGRAPHY.

Crystallisation.—The process (natural or artificial) by which the particles of liquid or gaseous bodies are converted into *crystals*, or solid bodies of a regularly limited form; *e.g.* the production of common salt by the evaporation of sea-brine, of sugar-candy by the evaporation of syrup. In mineral or unorganised bodies the ultimate or component particles are polygonal solids or crystals; in organised bodies they are hollow spherical cells. As in the organic world, therefore, every variety of structure is but the result of modifications of the primitive *spherical cell;* so in the inorganic world every rock and mineral is composed of original *angular solids*, or determinate modifications of these. Why calcareous spar should assume one form of crystal, and quartz or rock-crystal another, science cannot tell; but must, in the mean time, content itself with the determination and description of these curious and multifarious forms.

Crystallography (Gr. *krystallos*, and *grapho*, I write).—Literally, a description of crystals; that sub-science of Mineralogy which investigates the relation of crystalline forms, and the origin and structure of crystals. "The word *crystal* in Mineralogy designates a solid body, exhibiting an original (not artificial) more or less regular polyhedric form. It is thus bounded by plane surfaces named *faces*, which intersect in straight lines

or *edges*, and these again meet in points and form *angles*, which, when bounded by three or more faces, are named *solid angles*. The space occupied by a crystal, and bounded by its faces, is often named a *form of crystallisation*, which is thus merely the mathematical figure regarded as independent of the matter that fills it. Some crystals are bounded by equal and similar faces, and are named *simple forms;* whilst those in which the faces are not equal and similar, are named *compound forms* or *combinations*—being regarded as produced by the union or combination of the faces of two or more simple forms. The cube or hexahedron bounded by six equal and similar squares, the octahedral by eight equilateral triangles, and the rhombohedron by six rhombs, are thus simple forms. The *axis* of a crystal is a line passing through its centre, and terminating either in the middle of two faces, or of two edges, or in two angles; and axes terminating in similar parts of a crystal are named *similar axes*. In describing a crystal, one of its axes is supposed to be vertical or upright, and is then named the *principal axis*. When the axes of the crystals are properly chosen, and placed in a right position, the various faces are observed to group themselves in a regular and beautiful manner around these axes, and to be all so related to them as to compose a connected series produced according to definite laws. It appears that every mineral species is characterised by a certain form of crystal, with axes intersecting at fixed angles, and bearing to each other definite proportions, from which as a primary every other form of crystal observed in that mineral species may be deduced, simply by varying the proportion of these axes. When viewed in this manner, and referred to their simplest forms, it is seen that the innumerable variety of crystals occurring in nature may be all reduced to six distinct groups, or as they are named, *systems of crystallisation*. According to Naumann, these systems are the Tesseral, Tetragonal, Hexagonal, Rhombic, Monoclinohedric, and Triclinohedric; and a description of these, with their combinations and derivations, constitutes the main portion of Crystallography. In a description of these systems, the crystals are supposed to be *perfect;* that is, the planes smooth and even, and the faces equal and uniform. A perfect crystal can only be produced when during its formation it is completely isolated, so as to have full room to expand on every side. These conditions, however, seldom occur in nature; hence we have *imperfect* crystallisation, that is, crystals terminating abruptly, having their faces striated, rough and drusy, their edges curved, and their corners rounded. Amid all these changes and modifications, however, one important element remains unchanged—viz., their *angular measurement*. This is obtained either by the contact, or by the reflecting *goniometer*."—(*Manual of Mineralogy*, passim.) So far the determination of crystalline forms and species is strictly *mathematical*, and Crystallography, properly speaking, restricts itself to this formation; but as in nature minerals are often irregularly aggregated, and as the great bulk of the rocks have been formed under conditions that excluded the free development of regular crystallised forms, the mineralogist in his discriminations has to call in the aid of physical characteristics, such as *cleavage*, *fracture*, *hardness*, *lustre*, and *optical properties*—and even these only assume precision and geological importance when guided by the more exact and satisfactory results of *chemical analysis*.—See MINERALOGY.

Ctenis (Gr. *kteis*, *ktenos*, a comb).—A provisional genus of Professor

Lindley for certain cycadaceous-looking leaves, furnished with narrow pointed leaflets (hence their pectinated aspect), but differing from cycads in having their veins bifurcating instead of undivided and parallel.

Ctenoid, Ctenoidean (Gr. *kteis*, a comb, and *eidos*, form).—The third order of fishes in Agassiz' arrangement. They are distinguished by their scales, which are jagged or pectinated (like the teeth of a comb) on the posterior margin: these scales are formed of laminæ of horn or bone, but have no enamel. The *Ctenoideans* appear with the Chalk; the Perch is a familiar example.—See ICHTHYOLOGY.

Ctenoptýchius (Gr. *kteis, ktenos*, a comb, and *ptychê*, a wrinkle).—A genus of palatal fish-teeth belonging to the Cestraciont family, and found chiefly in the Carboniferous limestone. They are readily distinguished by the serrated or comb-like margin of their free-cutting edges.

Cube-Ore.—An arseniate of iron, of an olive-green or pistacio-green colour, and occurring in perfect cubes in the copper-ores of Cornwall and other localities.

Cucumítes (Lat. *cucumis*, a cucumber).—Fossil fruits from the London clay, so closely resembling the seeds of various members of the recent genus *Cucumis* (comprising the Gourd, Water-melon, &c.), both in outward form and internal structure, that there is no reasonable doubt of their belonging to plants of the same family; hence the name *Cucumites*, or fossil cucumbers.

Culm (Welsh).—An impure shaly kind of coal, or anthracitic shale. The culmiferous or anthracitic shales of North Devon are well known in Geology, and are sometimes treated as a lower carboniferous group under the term *"Culm Measures."*

Culmítes (Lat. *culmus*, a stem like that of corn).—A provisional genus of Tertiary articulated stems, with two or more scars at the joints.

Cúmbrian (the ancient *Cumbria*).—Professor Sedgwick's term for the lowest slaty and partially-fossiliferous beds of Westmoreland and Cumberland, as indicating an older and earlier system than the SILURIAN of Murchison.—See CAMBRIAN.

Cúneiform (Lat. *cuneus*, a wedge, and *forma*, likeness).—Wedge-shaped; *cuneate;* tapering like a wedge; a form characteristic of many mineral forms, and abruptly terminating stratiform masses.

Cupressinítes (*cupressus*, the cypress-tree).—A genus of fossil fruits occurring in tertiary strata, and evidently allied to those of the existing cypress. Known also as *Callitrites, Frenilites*, and *Solenostrobus.*

Cupressítes.—The generic term employed by Brongniart for all coniferous remains that are nearly allied to, or identical with, the existing cypress. Their leaves are enlarged at the base, sessile, and inserted spirally in six or seven rows; their fruit consists of peltate scales. They have been found in the Trias, Lias, Oolite, and Wealden.

Cupríferous (Lat. *cuprum*, copper, and *fero*, I bear).—Applied to veins, rocks, and other matrices containing the ores of copper, or copper in the native or metallic state.

Cuprite (Lat. *cuprum*, copper).—A mineralogical term for the *red oxide of copper*, known also as *octahedral copper ore*, from the form of its crystals, which are usually attached and combined in druses. It also occurs in granular or compact aggregates, has a metallic-adamantine lustre, a cochineal or shining red colour; and consists of 88.5 copper, and 11.5 oxygen. It is found in beds or veins, in granite, in the crystalline schists

and transition rocks, and usually along with other ores of copper, blende, galena, and pyrites.

Cuproplúmbite (Lat. *cuprum*, copper, *plumbum*, lead).—Literally *copper-lead*, a massive lead-grey ore, chiefly obtained from Chili, and consisting of 64.9 lead, 19.5 copper, 0.5 silver, and 15.1 sulphur.

Cursóres (Lat. *curro*, I run).—Runners or Coursers. An order of birds, so named from the peculiar adaptation of their legs and feet for running. The order includes the ostrich, emu, cassowary, and apteryx, in all of which the wings are merely rudimentary and unfitted for flight. Remains of gigantic *cursorial* birds (*Dinornis*, *Epiornis*, &c.) have been found in the Upper Tertiary and Newer Pleistocene formations.

Cúspidate (Lat. *cuspis*, a spear).—Spear-shaped; tapering abruptly to a stiff short point, in contradistinction to *lanceolate*, which indicates a slender and slowly tapering form.

Cutters.—A quarryman's term for any narrow crack or fissure that cuts or crosses the strata; hence "backs and cutters," for what is known to geologists as the *jointed* structure.

Cýanite (Gr. *kyanos*, azure blue).—One of the Garnet family, occurring in broad prismatic crystals, chiefly in mica and talc schists, and so called from its prevailing azure-blue colour. Transparent blue cyanite is often polished and substituted for sapphire, but is easily known from its inferior hardness.

Cýanose (Gr. *kyanos*, azure blue).—Sulphate of copper, or blue vitriol, a well-known substance, occurring in nature as a secondary production from copper pyrites, but more frequently prepared artificially—either by the roasting and lixiviation of pyrites and other copper ores, by treating these or metallic copper with sulphuric acid, or as a residuary product of metallurgic operations—used as a pigment and dye-stuff.

Cyáthiform (Gr. *cyathus*, a cup, and *forma*, likeness).—Cup-shaped; having the form of a cup, as certain flowers, polypes, corals, &c.

Cyathophýllum (Gr. *cyathos*, a cup or goblet, and *phyllon*, leaf).—A genus of cup-corals, having a turbinated polyparium or calcareous axis, simple or compound, and internally lamellated; the cells polygonal, radiated, and depressed or cup-like in the centre; whence the name. They are extremely abundant in Silurian strata, in the mountain limestone, and in the coral-rag of the Oolite. The simple turbinated forms are often of considerable size (the *turbinolia* of early authors), and from their shape are known by the familiar term of "petrified ram's-horns."

Cycadeoidea.—Literally *cycas-like*; a term which implies merely general resemblance, without hazarding any opinion as to absolute identity. A genus of roundish or oblong stems, covered with densely imbricated scales, and greatly resembling those of the cycas. They are found in the Lias, Oolite, and Wealden strata, and afford evidence of a warm genial climate in the latitudes where they occur.—See MANTELLIA.

Cycadítes.—Fossil plants of the younger secondary epochs—Oolite and Chalk—apparently allied to the existing cycas. The leaves only are known, and these are pinnated; leaflets linear, entire, adhering by their whole base, having a single thick mid-rib and no secondary veins.

Cyclas (Gr. *cyclos*, a circle).—A genus of fresh-water bivalves, having oval, transverse, equivalved shells, with the hinge-teeth very small; the substance of the shell thin and fragile. The species occur recent, and in the Tertiary and Wealden formations.

Cycle (Gr. *cyclos*, a circle).—Literally a circle of time, like the revolution

of the year and seasons; a periodical or recurrent space of time. Often loosely employed for periods of indefinite duration.

Cyclocládia (Gr. *cyclos,* circle, and *klados,* branch).—A name given to certain coal-measure plants, consisting of detached whorls of circular leaf-scars, each scar being about half an inch in diameter, and deeply pitted.

Cýcloid, Cycloidean (Gr. *cyclos,* a circle, and *eidos,* form).—The fourth order of Fishes in Agassiz' arrangement. They are distinguished by their scales, which are rounded, smooth and simple at the margin, and often ornamented with various figures on the upper surface: these scales are composed of laminæ of horn or bone, but have no enamel. The *Cycloideans* are chiefly tertiary and recent species; the salmon and herring are examples.—See ICHTHYOLOGY.

Cyclópteris (Gr. *cyclos,* a circle, and *pteris,* fern).—An extensive genus of fern-like plants, ranging from the Devonian to the Oolite inclusive; and so called from the rounded or circular shape of their leaflets, which are entire, have no mid-rib, but are thickly marked with dichotomous veins which radiate from the base to the margin.

Cýmbiform (Lat. *cymba,* a boat, and *forma,* likeness).—Boat-shaped; navicular; having the form of a boat or skiff, as many shells, the glumes of grasses, &c.

Cynochámpsa (Gr. *kyon,* dog, and *champsai,* crocodile).—A genus of Crocodilian reptiles, founded by Professor Owen on remains from the sandstone rocks of Rhenosterberg, South Africa; and so named from the large carnivorous-looking canines that arm the long slender jaws which terminate, as in Teleosaurus, in a single nostril.

Cyperítes (*cyperaceæ,* the rush-tribe).—Long, narrow, ensiform leaves which occur in the coal-measures, and so called from their general resemblance to those of the Cyperus. According to Lindley, *cyperites,* as a genus, is distinguished by the want of a mid-rib, and by the presence of parallel lateral veins.

Cypraéidæ (Lat. *Cypris,* a name of Venus).—The Cowry family, including the genera *cypræa, erato* and *ovulum.* The Cowries or Porcelain shells are carnivorous gasteropods inhabiting the shores of warm seas, and are well known from their convolute, enamelled, and often spotted, barred, and otherwise ornamented shells. In the young the spire is apparent, but in the adult shell it becomes concealed by the last whorl enveloping all the others. They occur fossil from the Chalk upwards, but are not known before that period.

Cypridína-Schiefer.—Slaty bands of limestone occurring, in Belgium and Germany, on the uppermost verge of the Devonian system; and so termed from their containing as their most characteristic fossil the small crustacean *Cypridina serrato-striata.* The "Cypridina-Schiefer" is regarded by M. Sandberger and Sir R. Murchison as the typical rock of the Upper Devonians of the Rhine district.

Cyprinoid (*cyprinus,* a carp, and *eidos,* likeness).—Carp-like; applied to many species of small fossil fishes which occur in the fluviatile and lacustrine deposits of the Tertiary formation, and which, like the living carps, seem to have inhabited fresh-waters, or the brackish waters of estuaries. Beautiful specimens are obtained from the Tertiary beds of Œningen and the marls of Aix — the latter locality also yielding vast numbers of **Cyprinodonts,** the recent species of which are also small fishes, inhabiting the fresh-water lakes of temperate zones.

Cypris, Cyprididæ.—A genus and family of minute crustaceans, having two enveloping crusts like those of a bivalve shell, but united by a dorsal fold without hinge. They inhabit the waters of lakes, marshes, and estuaries; moult or renew their integuments yearly; and are variously termed and divided by zoologists. Fossil forms under the generic terms of *Cypris, Cypridea, Cypridina, Cyprella,* and *Cypridella,* occur in all rocks from the Lower coal-measures upwards.

Cystídeæ (Gr. *cystis,* a bladder).—A family of Silurian echinoderms, so called from their spherical or bladder-like form: the *sphæronites* of earlier authors. They constituted, in the primeval seas, the representatives of the sea-urchins, of the secondary, tertiary, and current epochs; and appear to have been sessile, or furnished with a short foot-stalk, and not to have been free-moving, like the cidaris and echinus. According to E. Forbes, they have affinities with the Crinoids on the one hand (some possessing very perfectly formed arms and tentacles), and with the Sea-urchins on the other; while others also point out affinities to the Pentremites of the mountain limestone. The more frequent genera are *Echinosphærites, Pseudocrinites, Caryocistites, Hemicosmites, Echino-encrinus,* and *Crypto-crinites.*

Cystiphýllum (Gr. *cystis,* a bladder, and *phyllum,* leaf).—A genus of Silurian turbinated corals, externally striated, and internally composed of small bladder-shaped cells, hence the name.

Cythéridæ.—A family of entomostraca, or minute bivalve crustaceans, occurring in every formation; but most abundantly in the genera *cythere, cythereis,* and *cytherella* in the Chalk and older Tertiaries. There are doubts as to the precise affinities of the so-called palæozoic species.

D

Dadóxylon (Gr.)—Literally "pine or torch-wood;" Endlecher's generic term for fossil wood whose structure is apparently identical with that of the living species of Araucariæ; same as *Araucarites,* which see. Wood of this structure is common in the Lias, Oolite, Wealden, and Chalk.

Damps.—A miner's term for the gaseous products that are eliminated in coal-mines—carbonic acid being *choke-damp,* from its extinguishing life and flame, and light carburetted hydrogen being *fire-damp,* from its exploding when brought in contact with flame.

Dapédius (Gr. *dapedon,* a pavement).—A genus of ganoid fishes peculiar to the Lias, and so named from the arrangement of the rhomboidal scales resembling a tesselated pavement. The Dapedius is a wide, laterally compressed fish, with a rounded head, fins of moderate size, and body rapidly contracting, and terminating in an equally-lobed tail. The mouth is furnished with several rows of small conical teeth, crenated at their summits, and has brush teeth on the palatine bones.

Dásypus (Gr. *dasys,* hairy or rough, and *pous,* foot).—The zoological term for the Armadilloes, in allusion to the common character of their

feet, the soles of which are covered with strong hairs, and on which they walk, with their claws expanded. The armadilloes are edentate, that is, possess only grinders; are covered with a cuirass composed of strong horny rings; are nocturnal, live in burrows, and prey alike on animal and vegetable substances. They inhabit the warmer parts of South America, in the upper tertiaries of which are found the remains of the *Glyptodon*, and other extinct congeners.

Dátholite or **Datolite.**—A siliceous borate of lime, forming one of the Fluor-spar family, and occurring in various formations, in druses and in coarse granular masses. It consists of 38.3 silica, 21.5 boracic acid, 34.6 lime, and 5.6 water.

Davy-Lamp.—A form of lamp invented by Sir Humphrey Davy, and now extensively used in coal-mines subject to explosions of fire-damp. The principles involved in this invention are—*first*, that no mixture of fire-damp with common air, however dangerous, conveys an explosion through tubes or openings, tho diameter of which is less than about one-eighth of an inch; and, *secondly*, that these explosive mixtures need a much stronger heat for their explosion than mixtures of common inflammable gas, since neither charcoal nor iron at a red-heat will produce this effect, which requires, indeed, that iron be raised to a white heat. Proceeding upon these principles, the light of a lamp is surrounded by wire-gauze, the meshes of which are from $\frac{1}{40}$ to $\frac{1}{60}$ of an inch, and through these, any explosions that may take place inside the lamp are not communicated to the outside, so that the miner can pursue his calling with the light of a "*Davy*" in workings which would otherwise be unapproachable. There are several modifications of the Davy-lamp; but in all, the fundamental principles are the same.

Deads.—In mining, any vein-stone or mine-stuff, broken underground, that does not contain enough of ore to make it worth removing for dressing; mine waste; mine rubbish.

Débacle (Fr. *débacler*, to unbar). —A term originally signifying the breaking-up of the ice on a river—a freshet; but now applied to any sudden flood or rush of water which breaks down opposing barriers, and hurls forward and disperses blocks of stone and other debris.

Débris (Fr. wreck or waste).—A convenient term, adopted from the French, for any accumulation of loose material arising from the waste of rocks; also for drifted accumulations of vegetable or animal matter.

Decápoda (Gr. *deka*, ten, and *pous, podos*, foot).—Literally ten-footed; the highest order of crustacea, including all the stalk-eyed families, in which the whole of the thoracic segments are united with those of the head, into a single piece (the *cephalo-thorax*), encased in a common crust, with no traces of segmentary division (the *carapace*); and which have the branchial organs enclosed within a cavity on each side the cephalo-thorax. The true thoracic legs are almost always ten in number; whence the name of the order. The order includes three subdivisions—the *macrura*, or long-tailed, such as the crayfish; the *brachyura*, or short-tailed, as the common crab; and the *anomura*, or tailless, as the hermit-crab.

Decomposition (Lat.)—Literally "set free from composition:" the resolution of compounds into their elements, or the alteration of their chemical constitution in such a manner that new products are formed. Thus, we speak of *decomposing granite*, when its particles of quartz, felspar, and mica fall asunder under the action of the atmosphere; and of the further

decomposition of the felspar when it becomes converted into clay, and the soda, potash, and iron with which the clay was combined are set free.

Decórticated (Lat. *de*, from off, and *cortex*, the bark).—Having the bark, skin, husk, or other integument removed or stripped off. Thus, many fossil plants have their bark converted into a thin pellicle of coal, and accordingly their leaf-scars or external sculptures present very different aspects according as the specimens retain their bark, or are *decorticated*.

Decrépitate (Lat. *de*, and *crepito*, to make a crackling noise).—To fly in particles with a crackling noise when exposed to heat, as common salt and many other mineral substances do when they thus part with their water of crystallisation.

Deflagrátion (Lat. *de*, from, and *flagro*, to burn vehemently).—The sudden combustion of any substance for the purpose of producing some change in its composition by the joint action of heat and oxygen. The process is commonly performed by *projecting* into a red-hot crucible, in small quantities at a time, a mixture of about equal parts of *nitre* and the *body to be oxidised*.

Degradátion (Lat. *de*, down, and *gradus*, step).—Removing or wasting down step by step. The degradation of hills and cliffs is caused by atmospheric and aqueous agency; hence water is said to exert a *degrading* influence on the earth's crust; waves and tidal currents a *degrading* action on certain sea-shores. It is usual to arrange degrading causes or agencies into three sets—the *atmospheric*, or those connected with the atmosphere; the *fluviatile*, or those depending on rivers; and the *oceanic*, or those in which the ocean is the immediate agent.

Deinórnis, Dinornis (Gr. *deinos*, terrible or monstrous, and *ornis*, bird).—A gigantic cursorial bird, whose remains (fragments of eggs as well as numerous bones) have been discovered, in a sub-fossil state, in the river-silts of New Zealand. The affinities of the *Dinornis* or *Moa* of the natives are not yet clearly defined, though, according to Owen and Mantell, it has evidently been a wingless cursorial bird of great size and strength—varying from ten to fourteen feet in height, or considerably larger than the existing Ostrich. The epoch of the Dinornis is strictly post-tertiary, and the traditions of the natives would indicate its contemporaneity with the *Apteryx* and *Notornis*—wingless birds which still inhabit these islands. The *Palapteryx*, *Aptornis*, &c., are sub-fossil congeners, found in the same deposits.—See Mantell's *Petrifactions and their Teachings;* and Owen in *Zoological Transactions* for 1844-1850.

Deinosáurians, Dinosaur (Gr. *deinos*, monstrous, *saurus*, lizard).—Literally "fearfully-great lizards;" a term employed by Professor Owen to designate an order of terrestrial reptiles peculiar to the upper secondary formations, and comprising the *Iguanodon*, *Megalosaurus*, and *Hylæosaurus*, which see.—[*British Association Report on Fossil Reptiles*, 1841; *Dr Mantell's various works*.]

Deinothérium (Gr. *deinos*, terrible, and *therium*, wild beast).—A huge proboscidean mammal found in the miocene tertiaries of Europe and Asia. The zoological position of the *dinothere* (of which there seem to be several species) is not yet distinctly ascertained—the skull, molar teeth, and scapular bone being the only portions yet discovered. From these it appears that the animal was furnished with a short proboscis like the tapirs; lived on vegetable food, like the tapirs and lamantins; and had the lower jaw armed with two enormous tusks, depressed downwards, and

gently curved inwards. Professor Kaup regards the Dinothere as intermediate between the mastodons and tapirs, and truly terrestrial; while MM. Blainville and Pictet consider it an herbivorous cetacean which inhabited the embouchures of great rivers, and uprooted with its tusks the marsh and aquatic plants which constituted its food. "The adult dentition of Deinotherium (according to Dr Falconer) is characterised by two vertically succeeding premolars, and three true molars—five teeth in all, with transverse crenulated ridges closely resembling those of the tapir; and by two huge inferior recurved incisors, implanted in an enormously thickened and deflected beak, or prolongation of the symphasis of the lower jaw."

Delesserítes.—A genus of fossil Algæ (chiefly Tertiary), so named by Sternberg from their resemblance to the existing *Delesseria,* which has thin, flat, or undulated, smooth, membraneous fronds, with a median rib.

Deliquéscence (Lat. *deliquesco,* to melt away, to become liquid).—The property of certain salts to become liquid by their absorption of moisture from the atmosphere. Such salts are said to be *deliquescent.*

Delphínidæ (Lat. *delphinus,* a dolphin).—The Dolphin family; a tribe of cetaceans distinguished from the true whales chiefly by the more proportionate size of the head, which in general is about one-seventh of the entire length of the animal. The family includes the dolphins proper, with long slender snouts and numerous conical teeth; the porpoises; the narwhal, &c. Found fossil in the later Tertiary and Post-tertiary strata.

Delta.—The alluvial land formed at the mouth of a river such as that of the Nile, which received this name from the resemblance of the space enclosed by the two main branches of the river to the Greek letter Δ, *Delta.* The deltas of many existing rivers, such as the Mississippi, Niger, Ganges, &c., present the inquirer with the most instructive, perhaps, of geological phenomena—exhibiting in their magnitude, the variety of their composition, alternation of their beds, and the entombment of plants and animals, the perfect analogues of many of the older formations.

Dendrérpeton (Gr. *dendron,* a tree, and *erpeton,* a lizard).—A small lizard-like reptile, discovered by Mr Dawson and Sir C. Lyell in the lower coal-measures of Nova Scotia; so named from its being found in the interior of a fossil trunk, and thence supposed to have been of arboreal habits.

Dendrític (Gr. *dendron,* a tree).—Applied to certain branching moss-like appearances which occur on the surfaces of the fissures and joints in rocks. They are apt to be mistaken for fossil vegetation, but are strictly inorganic, and of chemical origin—as much so as the dendritic frost-work of a winter's night on the surface of a window-pane.

Déndrodonts (Gr. *dendron,* a tree, and *odous,* tooth).—An extinct family of fishes, characteristic of the Old Red Sandstone or Devonian system; and so called from the section of their seemingly simple conical teeth, which presents numerous fissures radiating or *spreading like the branches of a tree* from a central mass of "vasodentine," or vascular uncalcified tissue.

Déndrolite (Gr. *dendron,* tree, and *lithos,* stone).—Fossil wood; a general term for any fossil stem, branch, or other fragment of a tree.

Dénsity (Lat. *densus,* thick, set close).—That property of bodies which relates to the comparative *compactness* or closeness of their component particles or molecules—bulk for bulk, the *denser* being the *heavier.* As

gravity is thus in proportion to density, the specific gravity of bodies is taken as the measure of their densities.—See Gravity, Specific.

Déntine (Lat. *dens,* tooth).—The tissues that compose the teeth in vertebrate animals are arranged by anatomists into *dentine,* which forms the body of the tooth; *cement,* which forms the outer crust; and *enamel,* which (when present) is situated between the dentine and cement.

Dentítion (Lat. *dens,* a tooth).—The period at which the teeth of mammalia make their first appearance through the gums; also the character and arrangement of the teeth in different families, which becomes a most important aid to the palæontologist in the discrimination of fossil species.

Denudátion (Lat. *de,* down, and *nudus,* naked).—Laying bare by removal. The removal of superficial matter, so as to lay bare the subjacent strata, is an act of denudation; so also the removal by water of any formation, or part of a formation. We thus speak of *denuded* rock-surfaces, and of strata destroyed or removed by *denudation.* Before a current of water can lay down a quantity of matter in one place, it must manifestly take it up from another; hence, as a geological operation, denudation must accompany and precede deposition.

Deóxidised; Deoxidated.—Literally, "deprived of oxygen;" disunited from oxygen.

Depósit (Lat. *de,* down, and *positus,* placed).—Applied to matter which has settled down from suspension in water. Mud, sand, &c. are deposits, so also are the shales, sandstones, &c. of older date. Deposits are usually distinguished by the positions in which they occur, or by the agencies concerned in their formation, as fluviatile, lacustrine, æstuary, marine, &c. The *deposition* of rock-matter is going forward less or more rapidly in all waters on the surface of the globe.

Derby-Spar.—A familiar name for fluate of lime or fluor-spar, from its occurring abundantly in the Derbyshire limestones.—See Fluor-Spar.

Dercétis (Gr. a sea-god, so termed from his glittering scales).—A ganoid, eel-like fish of the Chalk formation, belonging to the family of *Plectognathi,* and known to the quarrymen as "petrified eel." In *Dercetis* the body is very elongated (often two and three feet long); the head short with a pointed beak, the upper jaw being a little longer than the lower; and both jaws armed with long, conical, elevated teeth, and several rows of very small ones. On each side of the fish there are three rows of osseous scutes like those of the sturgeon—the rest of the body being also covered with small scales.

Dermal (Gr. *derma,* the skin).—Belonging to the skin; hence we speak of the *dermal* or enveloping integuments of plants and animals.

Dermo-skeleton (Gr. *derma,* the skin).—The hard integument which covers and affords protection to most invertebrate, and also to many vertebrate animals; the *external* or "exo-skeleton," in contradiction to the *internal* or true bony skeleton of the higher animals. It makes its appearance as a tough coriaceous membrane, as shell, crust, scales, horny scutes, &c.; but never as true bone.

Desiccation, Dessication Cracks (Lat. *de,* and *siccus,* dry).—The drying of solid bodies by the evaporation of whatever moisture they may contain. Thus clay and clayey beds are *desiccated* by the sun's heat, and as they become dry they shrink and crack in all directions. Were such beds to be overlaid by a new deposit of mud or other soft matter, portions of it would enter these cracks, and the two strata, on being separated (after consolida-

tion) would present—the lower the "mould," and the upper the "casts" of these fissures. Such appearances are frequent among the strata of all formations, are known as *desiccation cracks,* and are not to be confounded with "joints," "cleavage," and similar phenomena.

Detrítus (Lat. *de,* down, and *tritus,* rubbed or worn).—An appropriate term for accumulations arising from the waste or disintegration of exposed rock-surfaces. *Detrital* matter may thus consist of clay, sand, gravel, rubbly fragments, or of any admixture of these, according to the nature of the rocks and the amount of attrition to which their particles have been subjected.

Devónian.—A common, but not always appropriate, synonym of the Old Red Sandstone, portions of which are extensively developed in Devonshire. The term was introduced by Sir R. Murchison (and harmonises with his "Silurian," "Permian," &c.), "because the strata of that age in Devonshire—lithologically very unlike the Old Red Sandstone of Scotland, Hereford, and the South Welsh counties—contain a much more copious and rich fossil fauna, and were shown to occupy the same intermediate position between the Silurian and Carboniferous rocks."—See OLD RED SANDSTONE.

Dévonite.—A name given by Dr Thomson to *Wavellite,* a phosphate of alumina originally discovered by Dr Wavel in the north of Devonshire.—See WAVELLITE.

Déxtral (Lat. *dexter,* belonging to the right hand—right-handed).—This term is usually applied to spiral shells whose whorls, when the mouth is placed towards the observer, turn from left to right; and this is the general course in nature. *Sinistral* or *reversed* shells are those whose spires turn from right to left. In other words, when spiral shells are placed vertically with the spires uppermost, and the mouth towards the observer, the aperture in *dextral* shells is towards the *right;* in *sinistral* it is towards the *left.*

Diabase.—A term adopted from the French, and occasionally applied to those greenstones whose constituents are hornblende and felspar; same as *Diorite.*

Diallage (Gr. *diallagè,* interchange).—A siliceo-magnesian mineral, having a laminated or bladed cleavage, and so called from its changeable colour —forms *diallage rock,* and enters into the composition of serpentine. Closely related to *Schiller-spar,* which see.

Diállogite.—Manganese spar, or red manganese; a carbonate of manganese occurring in crystallised druses, in columnar aggregates, or in granular masses; having a rose-red or flesh-red colour, and glassy pearly lustre. It is found in various formations, but chiefly in veins in gneiss and porphyry along with silver, galena, blende, hæmatite, and other ores.

Diamond (Gr. *adamus,* unsubdued).—The diamond; so called in allusion to its unparalleled hardness. The diamond is the most precious of known gems; and, chemically speaking, is carbon or charcoal in its pure and crystallised form. This form is primarily that of a regular octahedron, but of this there are numerous modifications; and the crystals having often curved faces, they more or less approximate to spheres. They occur loose in alluvial sands and gravel; or singly imbedded—in a matrix of sandstone in India, and of mica-slate in Brazil and South America. Geologically, they have been found chiefly in India and Borneo, and the Brazils; more sparingly and in minor crystals in the Urals, in the Carolinas, and in Mexico. The "Diamond Sandstone" of India, and which furnishes the

detritus in which most of the specimens are found, is apparently of tertiary or recent origin; the age of the micaceous schists which yield the diamonds of Brazil and the Urals is unknown. Diamonds are found of all colours; those which are colourless, or which have some very decided tint, are most esteemed; those slightly discoloured are the least valuable. Diamonds are cut and polished only by their own dust or powder—an art known from remote antiquity in the East, but introduced into Europe only about the end of the fifteenth century. They are cut chiefly into three forms—*table, rose,* and *brilliant;* the latter having the finest effect, but requiring a greater sacrifice of bulk—some crystals being reduced nearly one half in weight by the operation.

Respecting the origin of the diamond, neither Chemistry nor Geology has thrown much light on the subject. We know that it consists of carbon in its purest and most concentrated form; but whether this carbon is of vegetable or of animal origin, or whether it may not be a purely chemical elimination altogether apart from organic growth, science has not yet determined. It is true that some observers have thought they detected traces of vegetable structure in the ashes of the diamond, but their observations have not been confirmed; and none of the specimens containing foreign matter have as yet given any hint of their origin. It has been remarked that their occurrence in mica-slate does not favour the idea of their immediate vegetable origin; nor does their occurrence in a soft quartzose sandstone indicate the operation of excessive heat. Indeed, their combustible nature forbids the idea of intense heat in connection with their formation; and yet high heat under pressure, or a long-continued low heat manifesting itself in chemical change, may have effected the crystallisation of carbon in decaying organic matter. Unlike amber, however, diamonds are never found in connection with vegetable or animal substances; so that the primary source of their carbon, as well as the cause of its subsequent crystallisation, remains a mystery.

Diáphanous (Gr. *dia,* through, and *phano,* I appear).—Applied to gems and minerals that may be seen through; transparent; pellucid.

Díceras (Gr. *di,* two, and *keras,* horn).—A massive bivalve of the upper and middle oolites; belonging to the *Chamidæ* or Clam-shells; and so termed from its prominent *umbones* or beaks, which are twisted backward in ram's-horn fashion, and furrowed externally by ligamental grooves. There are several species in which the beaks are more or less spiral and horn-like, and the valves less or more unequal.

Dichobúne (Gr. *dicha,* divided in two, and *bounos,* a ridge).—A genus of anoplotheroid quadrupeds whose remains occur chiefly in the eocene or lower tertiaries of Europe; so called from the deeply-cleft ridges of the upper molars.

Díchodon (Gr. *dicha,* in two parts, and *odous, odontos,* a tooth).—A middle tertiary artiodactyle (even-toed) mammal, showing affinities, according to Owen, to the Hog-tribe among the non-ruminant section, and to the Camel-tribe among the ruminants,—so called from the double crescent-shaped lines of enamel on the upper surface of its true molars.

Dichroism (Gr. *dis,* twice; *chroa,* colour). — The property by which a crystallised body assumes two or more colours, according to the direction in which light is transmitted through them; hence the *Dichroite* of Cordier,—a silicate of alumina and magnesia which exhibits three or more colours along its chief axis.

Dicotylédonous (Gr. *dis,* double, and *cotyledon,* seed-lobe).—A grand division of the vegetable kingdom, comprising all those plants whose seeds are composed of two lobes or seed-leaves. They are exogenous, or increase by external layers of growth, and the venation of their leaves is reticulated or net-like, and not in parallel order, as in monocotyledonous endogens.—See tabulations, "Vegetable Scheme."

Dictyophýllum (Gr. *dictyon,* a net, and *phyllon,* leaf).—Literally "Net-leaf;" a provisional genus erected for the reception of all unknown fossil dicotyledonous leaves which exhibit the common reticulated structure. *Dictyophylla* have been found as low as the Trias and Permian.

Dicýnodon (Gr. *di,* two; *cyon,* dog; and *odous,* tooth).—Literally "two canine teeth;" a provisional genus of very peculiar reptiles occurring in a sandstone, supposed to be of Triassic age, in Southern Africa. The principal remains yet found are the bones of the head, which seem to indicate a gigantic type between the lizards and turtles. The eye orbits are very large, the cranium flat, with nostrils divided as in lizards; and the jaws toothless, with the exception that the upper jaw possesses a pair of long tusks, implanted in sockets and turned downwards like those of the walrus—hence the name *dicynodon.*

Didélphys, Didelphidæ (Gr. *dis,* two, and *delphys,* womb).—The opossum family, so termed from their external abdominal pouch or *marsupium,* in which the fœtus is placed after a very short period of uterine gestation, and where it remains (as if in a second womb), suspended to the nipple by its mouth until sufficiently matured to come forth to the open air. Remains of *didelphine* animals occur so early as the Oolitic if not Triassic formation.

Didýmium.—One of the rarer metals, of whose properties little is yet known, found along with *lanthanum* in the ores of *Cerium,* which see.

Didymográpsus (Gr. *didymos,* twin or double, and *grapsus*).—The twin or double graptolite; a common form in the Silurians of Wales and Scotland, having the stems or axes united in pairs. The cells are arranged in single rows as in the common graptolite, but the axes are in twins, or two-branched.

Die Earth.—A local term at Coalbrook Dale for the Wenlock shale, because this stratum lies beneath all the mining ground of the district—the minerals "dying out," as it were, at this stage of descent.

Differentiate, Differentiation.—In Zoology, the vital functions are said to be more and more "differentiated," when, instead of several functions being performed by the same organ, each function is performed by an organ specially devoted to it. "Differentiation" is, therefore, a mark of higher organisation—the higher the animal in the scale of being, the more specialised is its organisation.

Digitate (Lat. *digitus,* a finger).—Finger-shaped. Applied to bodies whose parts expand in finger-like process; *e.g.* the *alcyonia,* or "dead-men's-fingers" of the sea-shore; the *scorpion strombus,* whose outer lip is armed with strong finger-like spines; the leaves of the horse-chestnut, &c.

Digitagráda (Lat. *digitus,* the toe, and *gradus,* a step).—An extensive tribe of the *Carnivorous* animals, as the lion, tiger, cat, weasel, &c., whose feet are constructed for walking on the toes, and therefore capable of a swift bounding motion, as compared with the slow shuffling walk of the *Plantigrades* (bear, badger, &c.), that set down the entire phalanges of the foot.

Dilúvium, Diluvial (Lat. *dis,* asunder, and *luere,* to wash).—Alluvium

(which see) has been described as the term usually applied to matter brought together by the *ordinary* operations of water; diluvium, on the other hand, is regarded as implying the *extraordinary* action of water. In this sense it was at one time restricted to those accumulations of gravel, &c. supposed to have been the result of the Noachian deluge; but it has now a wider signification in Geology, being applied to all masses apparently the result of powerful aqueous agency.

Dilúvialists.—Theorists who regard the boulder-clay, abraded and polished rock-surfaces, ossiferous gravels, and similar superficial phenomena, as the results of the Noachian deluge; in other words, those who ascribe to a universal deluge such superficial results as they cannot readily reconcile with the ordinary operations of water now going on around them.

Dimórphism (Gr. *dis*, two, and *morphè*, form).—"It is sometimes supposed," says Nicoll (*Manual of Mineralogy*), "that each particular substance can crystallise only in one particular form or series of forms. Mitscherlich has, however, shown that this is only partially true, and that sulphur, for instance, which usually crystallises in the rhombic system, when melted may form monoclinohedric crystals. This property is named *dimorphism*, and has been explained by its discoverer on the principle that the form, and with it the other physical characters of a body, depend not merely on the chemical nature of the atoms, but also on their relative position. Hence the same chemical substance may form two, or even more, distinct bodies or mineral species. Thus carbon in one form is the diamond, in another, graphite; and carbonate of lime appears as calc-spar or as arragonite. Even the temperature at which a substance crystallises influences its forms, and so far its composition as seen in arragonite, Glauber salt, borax, &c."

Dimyaria (Gr. *dis*, twice, and *mus*, a muscle).—That division of the conchiferous bivalves whose shells are closed by two adductor muscles, as the common edible mussel.—See CONCHIFERA.

Díopside.—A variety or sub-species of augite, occurring in various shades of greyish-green, and crystallised in broad columnar or concentric lamellar aggregates. A similarly crystallised body has been produced by fusing silica, lime, and magnesia in due proportion.—See AUGITE.

Díoptase (Gr., capable of being seen through).—Emerald copper, or rhombohedral emerald malachite; occurring in fine emerald-green transparent or translucent crystals, and consisting of 38.7 silica, 50 copper protoxide, and 11.3 water. It is found in limestone veins in Tartary, and when first brought to Europe was sold as emerald.

Díorite (Gr. *dioros*, a clear distinction).—A variety of greenstone, composed of hornblende and felspar, and of a dark colour, in consequence of the disseminated plates of hornblende. It receives its name from being unmistakable, in contradistinction to *dolerite*.

Dip.—The inclination or angle at which strata slope or dip downwards into the earth. This angle is measured, of course, from the plane of the horizon or level, and may be readily ascertained by the common spirit-level and plummet, or, as is usual among geologists, by a small pocket instrument called the *clinometer* (which see). The opposite of *dip* is the term *rise;* and either may be used, according to the position of the observer. Thus, standing on the surface, we speak of a bed of coal *dipping to the south;* while at the bottom of the pit, the miner, looking at the

same bed, would say that it *rose to the north.* It is usual, on geological maps, to indicate the direction of the dip by an arrow, and the line of outcrop or *strike* of a stratum by a bold line—the one being at right angles to the other.—See STRIKE.

Diplográpsus.—Literally "double graptolite." That section of graptolites in which the cells are arranged in two rows—one on each side the central axis, like the feathers on a quill. The diplograptolites have a foliaceous appearance, and are presumed to resemble the existing Pennatula and Virgularia.—See GRAPTOLITE.

Diprion (Gr. *dis,* two, and *prion,* a saw).—Literally "double-saw." A synonym of *diplograpsus*—the serrated cells on each side the central axis giving the organism the appearance of a double-saw.

Dipródodon (Gr. *dis,* two, *protos,* first, and *odous,* tooth).—A gigantic pachydermoid marsupial mammal from the pleistocene or upper tertiary beds of Australia; and so termed from the large scalpriform character of its incisors or front teeth. The head of a specimen now in the British Museum measures three feet in length, and gives some idea of the immense size of the creature, which, while nearly related to the kangaroo, has, according to Owen, "osculant relationship with the herbivorous wombats." The hind limbs are shorter and stronger, and the front limbs are longer and stronger than those of the existing kangaroos.

Dipyre (Gr. *dis,* and *pyr,* fire).—One of the Scapolite family, usually imbedded in slate or limestone, and occurring in rounded eight-sided prisms. Consists of 55.5 silica, 24.8 alumina, 9.6 lime, and 9.5 soda; and is said to derive its name "from its twofold susceptibility to the action of fire. When heated before the blow-pipe it first becomes phosphorescent, and then fuses."

Dirt-Beds.—The name given to certain dark-coloured loam-like beds that occur interstratified with the oolitic limestones and sandstones of Portland—evidently the soils in which grew the cycads, zamias, and other plants of the period. "At the distance of two feet," says Mr Bakewell, "we find an entire change from marine strata to strata once supporting terrestrial plants; and should any doubt arise respecting the original place and position of these plants, there is over the lower dirt-bed a stratum of fresh-water limestone, and upon this a thick dirt-bed, containing not only cycadeæ, but stumps of trees from three to seven feet in height, in an erect position, with their roots extending beneath them. Stems of trees are found prostrate upon the same stratum, some of them from twenty to twenty-five feet in length, and from one to two feet in diameter."

Díscous, Discoid (Gr. *discus,* a quoit, and *eidos,* likeness).—Quoit-shaped; in the form of a disc; *e.g.* the shell of the *planorbis.*

Disíntegration (Lat. *dis,* asunder, and *integer,* whole).—The breaking asunder of any whole or solid matter. The disintegration of rocks is caused chiefly by the slow action of frosts, rains, and other atmospheric influences; and the facility with which some kinds are acted upon by these influences depends partly on their chemical composition, partly on the aggregation of their particles, and partly on the readiness with which they absorb moisture.

Dislocation (Lat. *dis,* asunder, and *locus,* place or position).—A general term for any displacement of the stratified rocks from their original horizontal or sedimentary position. *Slips, Faults,* and the like, are "dislocations."

Disrupting (Lat. *dis*, asunder, and *ruptus*, rent or broken). — When igneous matter forces its way through the stratified rocks, and fills up the rents and fissures so made, it is termed *disrupting;* when, having passed through the strata, it spreads over their surface in sheet-like masses, it is said to be *overlying;* and when these discharges have taken place at the bottom of the sea, and have been in turn covered over by new deposits of sediment, they then appear as *interstratified.*

Dithyrócaris (Gr. *dithyros*, having two valves, and *caris*, shrimp).—A genus of phyllopod crustaceans first discovered by Dr Scouler in the coal shales of Lanarkshire, and so named from its being enclosed, like the existing genus *apus*, in a thin flattish bivalved carapace. The abdominal portion, which is not enclosed in the carapace, consists of five or six segments, and terminates in a trifid tail like *Ceratiocaris.*

Divaricating (Lat. *dis*, asunder, and *varico*, I stride).—Applied to roots, branches, and other members that spread widely and decidedly from each other.

Divining-Rod, known also in Cornwall and Wales as the *Dowsing-Rod;* a hazel-rod by the aid of which some persons pretend to be able to tell where water and minerals lie below the surface by a process of divination. The rod is balanced in the hands of the diviner in a peculiar way, and is supposed to indicate the position of the substance sought, by turning towards it with a slow rotatory motion. This superstition is occasionally still practised, and passes under the learned names of *Metalloscopy*, *Hydroscopy* or *Rhabdomancy*—the last of which see.

Divisional Planes.—A technical term for those lines of separation which traverse rock-masses, and divide them into blocks or fragments, more or less regular. It is usual to speak of them as *congenital*, or those which, like lamination and stratification, are formed at the same time as the rocks themselves; *resultant*, or those arising like joints, from consolidation and contraction; *accidental*, such as fissures, faults, and veins; and *superinduced*, or those which, like cleavage and foliation, are accompanied by a change in the internal structure of the rocks themselves.

Dodo.—An extinct gigantic bird belonging, as has been shown by MM. Strickland and Melville in their monograph—*The Dodo and its Kindred*—to the order Columbæ or Pigeons, and constituting the type of a new family (the *Dididæ*), to which several fossil species have been ascribed. At the discovery of the Island of Mauritius in 1598, the Dodo was still abundant there, and formed a principal portion of the food of the inhabitants; but in the course of a few years it was completely extirpated by the sailors, and its bones are now found only in the silt and tufaceous deposits of that island. A few specimens were, however, brought to Europe in the period which intervened between its discovery and its final destruction, and from these several paintings were made, which, with two heads, a foot, and a few feathers, are now the only proofs of the existence of a large bird which was certainly living within the last two hundred years. The Dodo is described as having been considerably larger than a swan, weighing sometimes fifty pounds; of a very bulky and heavy form; having a strong predaceous bill hooked at the tip; face or front of the head covered with a naked skin; feet short and stout, but resembling those of a pigeon; wings short, incapable of flight, and composed of soft tufty plumes like those of the ostrich. The *Solitaire*, and other kindred species said to have recently existed in the islands of the Mauritius, are in like manner extinct;

and the nearest living approach to the family now known is the little *Didunculus* of the Navigators' Islands.

Dólerite (Gr. *doleros,* deceptive).—A variety of greenstone, composed of felspar and augite; so called from the difficulty of discriminating these compounds.—See DIORITE.

Dolichosáurus (Gr.)—Literally "Long Lizard;" a snake-like reptilian, whose remains, found in the Chalk formation, indicate a creature from two to three feet in length, and probably of aquatic habits. According to Professor Owen, the *Dolichosaurus* presents somewhat of the ophidian character in the number and size of its cervical vertebræ, in the size and shape of its ribs, and in the slender proportions of its trunk and head; but with these partial exceptions, its affinities are truly lacertian.

Dólomite (after the French geologist Dolomieu). — A crystalline, or granulo-crystalline, variety of magnesian limestone, occurring largely in many secondary formations, and often in the vicinity of igneous rocks whose heat seems, in most instances, to have been the proximate cause of the superinduced crystalline texture. Ordinary magnesian limestone, though occurring in all stages of compactness, is void of this crystalline texture.—See MAGNESIAN LIMESTONE.

Dómite.—A granular arenaceous-looking variety of trachyte found in the Puy de Dome, Auvergne: hence the name.

Dórsal (Lat. *dorsum,* the back).—Appertaining to the back; as the *dorsal* vertebræ or vertebræ of the back; the *dorsal* fin, or back-fin, &c.

Drift.—Literally, "that which is driven;" as *sand-drift,* sand driven and accumulated by the wind; *drift-wood,* wood carried down by rivers and driven by tides and currents to distant shores. In Geology the word is frequently used as an abbreviated term for the "Glacial Drift," "Northern Drift," or "Diluvial Drift" of the Pleistocene epoch.—See GLACIAL DRIFT.

Dromatherium (Gr. *dromaios,* swift-running, and *therion,* beast).—The name given to a small mammal, teeth, jaws, and detached bones of which have been discovered by Mr Emmons in the Red Sandstones of Virginia and N. Carolina—strata which, by some, are regarded as Triassic, and by others as the equivalents of our European Permians. Supposed to be like *amphitherium* and *phascolotherium,* of marsupial affinity.

Druse (Gr. *drosos,* dew).—A mineralogical term for any hollow space in veins of ore, or vesicular cavity in igneous rocks, like amygdaloid, that is lined or studded with crystals—literally "dewy with crystals;" hence we speak of *drusy* and *sparry* cavities.

Dryopithécus (Gr. *dryos,* a wood, and *pithecus,* ape). — Literally "tree-monkey;" the generic term applied by M. Lartet to a large species of monkey found in the miocene beds of the south of France, and apparently to the modern long-armed apes (*hylobates*).

Ductility (Lat. *ductus,* drawn out).—The property which certain metals possess of being drawn out into wire or thread-like filaments more or less slender. Platinum, gold, and silver, are the most ductile of the metals—a single grain of gold being capable of being drawn into a wire nearly 600 feet in length!

Dune (Brit., a hill).—Usually applied to hillocks of blown sand. *Sand-dunes,* sand-drift, like that which, in so many places, skirts the shores of our own island.

Dunstone.—A local term for certain magnesian limestones of a yellow-

ish dun or cream-colour, occurring in the valley of the Derwent, near Matlock, in Derbyshire. They are of a granular texture, extremely hard, and rich in lead and calamine, for which they have been extensively mined.

Dyke (Scot., a wall or fence).—Applied to those wall-like intrusions of igneous rock which fill up rents and fissures in the stratified systems. In general they burst through and displace the strata, though occasionally they merely fill up pre-existing rents and fissures. When the matter of the dyke is harder than the intersected strata, and these have been subjected to waste and denudation, the igneous wall-like mass may be traced for miles across a country; and, on the other hand, where the rock-matter of the dyke has been softer, its course may also be traced by narrow wall-sided fissures and linear ditch-like depressions. Both phenomena are well exhibited in the island of Arran.

E

Eagle-Stone.—The *ætites lapis* of the ancients, fabled to have been hatched in the nest of the eagle. A variety of nodular argillaceous iron-ore, having a concentric structure, and occasionally so decomposed within as to have a loose kernel which rattles on being shaken. This kernel was known by the name of *callimus,* and was supposed to be the young in the womb of the parent nodule; hence the fable of the *ætites* bringing forth young. When there is no internal kernel the nodule becomes a *geode,* which see.

Ear-bones.—The tympanic or petro-tympanic bones of the higher osseous and cartilaginous fishes, as well as those of whales, are of frequent occurrence in a fossil state in the Crag of Norfolk, and other tertiary strata. They are termed *otolithes* or *otolites,* that is, "ear-stones;" and though varying greatly in size and configuration, are readily distinguished from other bones by their greater density and smooth unattached forms.—See OTOLITES.

Earth.—In Chemistry, a solid, opaque, friable substance, without lustre and incombustible; it is thus distinguished from metals on the one hand, and from carbon and other combustible substances on the other. The *primitive earths* are thus said to be—*baryta, strontia, lime, magnesia, alumina, glucina, zirconia, yttria, donaria,* and *thorina.* The first four are termed *alkaline earths* from their partial solubility in water, their alkaline taste, and their action on vegetable colours; the remainder constitute the *earths proper,* are insoluble in water, and only imperfectly neutralise the acids. In Geology, as well as in familiar language, the word EARTH is often loosely employed—the *earths* of the agriculturist being the soils he cultivates, while *fuller's earth* (an absorbent clay), *bone-earth* (phosphate of lime), and the like, are everyday terms. The epithet *earthy* refers more strictly to the character and consistency of a rock, as an "earthy limestone," meaning thereby that it is soft, friable, and non-crystalline. In Geography, the distinctive name for our planet, as associated with the Sun, Moon, and other bodies of the solar system; hence such phrases as the

"Earth's mass," "Earth's orbit," "Earth's axis of rotation," and so forth.

Earth's Crust.—That external rind or shell of our planet which is accessible to human investigation; in contradistinction to the internal mass of which we can know nothing by direct observation; the *Erd-rinde* of the German geologists.—See TEMPERATURE OF THE EARTH.

Earth of Bone.—A phosphate of lime, sometimes termed "bone phosphate," existing in bones after calcination.

Earthquake.—The familiar as well as technical term for any shaking or tremor of the earth's crust produced by subterranean agency. As the name implies, an earthquake consists of an agitation of some particular portion of the earth—the shock or convulsion being less or more violent, and extending over a less or greater area, according to the intensity of the motive power, and according to conditions of internal structure, with which we are but slenderly acquainted. The conditions accompanying earthquakes are by no means uniform, and though science has recorded a great many facts in connection with their occurrence, it is by no means in a position to enunciate any law either as regards their premonitory warnings, their intensity, their duration, or the direction of their movements. In some instances they are preceded by an unusual stillness of the air, by an unnatural agitation of the waters, and by hollow subterranean rumblings. In others, the shock comes on at once with or without noise—the earth is violently agitated by perpendicular lifts or heaves—rolls from side to side —or undulates with uneasy motion as if it were floating away from beneath the feet of the observer. The single shock of an earthquake seldom lasts more than a minute—often for a few seconds only; but they frequently follow each other after short intervals, and for a considerable length of time, and these paroxysms occur at certain periods more intensely than at others. Of course such movements of a solid, unelastic, and variously composed mass like the earth's crust—as if it were extensively cavernous, or floated on a sea of molten matter—must be followed by fractures, fissures, and chasms; by upheavals and depressions; by elevations of the sea's bed into dry land, and the submergence of dry land beneath the waters of the ocean. Of all these we have abundant evidence and record within the historical period; and the further testimony that these fissures often emit smoke and flame, and more frequently discharge fragments of stone and torrents of water.

From these and similar circumstances, as well as from their greater frequency in volcanic districts, there can be little doubt that earthquakes are intimately associated with volcanoes—in fact, are but varied expressions of the same primal agency. They produce modifications of the earth's crust chiefly by fracture, subsidence, and elevation. During their convulsions the level plain may be thrown into abrupt heights or rent by chasms and ravines; lakes may disappear and rivers change their courses; islands may be submerged or elevated and joined to the mainland; and maritime tracts may be sunk beneath the waters, or the adjacent sea-bed raised into dry land. Their *Geological function* is therefore, like that of volcanoes, to diversify the surface of the globe, and to render irregular what aqueous agency is perpetually striving to render smooth and uniform. Presuming on the uniformity of nature's operations, in subordination to the higher law of Creational Progress, the effects of earthquakes must have been similar in all time past, and to them, therefore, must be

ascribed many of the fractures, dislocations, and contortions, so prevalent among the earlier rock-formations of the globe.

Eboúlement (Fr. *ébouler*, to tumble down).—A term adopted from the French for sudden rock-falls and earth-slips in mountainous regions.

Ebullition (Lat. *ebullitio*, a boiling or bubbling up).—The boiling or bubbling up of liquids after they have been heated to the *boiling-point*. Many thermal springs are in a state of constant ebullition.—See BOILING POINT.

Echínida, Echinoidea (Gr. *echinos*, the sea-urchin).—A well-known family of the Radiata, comprehending those marine animals commonly known by the name of *sea-eggs* or *sea-urchins*, and constituting, according to Zoologists, the third order of the class *Echinodermata*, which see. The Echinida are found fossil in all formations, but are most abundant and beautifully preserved in the Chalk.

E'chinite.—The general palæontological term for any fossil, sea-urchin, or cidaris, or portion thereof. *Echinites* are common in many formations, and wherever they occur give evidence of true marine conditions.

Echinodérmata (Gr. *echinos*, and *derma*, the skin).—A numerous class, recent and fossil, of Radiata like the star-fish and sea-urchin—all less or more covered with a firm coriaceous or crustaceous integument, which in many instances is densely armed with spines. It embraces, according to recent zoological arrangements, the following orders:—

1. The *Crinoida*, or those species, almost exclusively fossil, which are fixed by a long jointed stalk, and have branching articulated tentacula extending from around the abdominal cavity, as in the common *encrinite*.

2. The *Asterida* or *Stellerida*, comprising the free, flexible, and star-shaped species, which are destitute of stalk or peduncle, as the common star-fish (*asteria*). The asterida are recent as well as fossil in all formations.

3. *Echinida*, in which the body is inflexible, and composed of a solid articulated crust, the exterior surface of which is covered with movable calcareous spines, as in *echinus*. Recent as well as fossil in all formations.

4. The *Holothurida*, in which the axis of the body is placed horizontally, and there is a soft coriaceous skin, seldom protected with spines as in *holothuria*.

Or including fossil genera, we have the further subdivisions given in the preliminary tabulations, "Animal Scheme."

Echinostáchys (Gr. *echinus*, a spine, and *stachys*, a head of flowers).—A term applied to a singular fossil occurring in the new red sandstone; apparently a spike of inflorescence, beset on all sides with sessile, contiguous, sub-conical flowers or fruits. Supposed to be akin to the *Typhaceæ* or Reed-maces.

Ecume de Mer, or **Meerschaum.**—Literally "foam of the sea;" a light white earthy carbonate of magnesia, much esteemed for the bowls of tobacco pipes.—See MEERSCHAUM.

Eddy (Sax. *ed*, water, and *ea*, backwards).—Any rotatory motion of water caused by the meeting of opposing currents. Eddies generally occur in estuaries where the tide meets the current of the river; and in seas where currents from different quarters meet, or where tidal currents are thrown back on themselves by opposing obstacles.—See WHIRLPOOL.

Edentáta (Lat. *edentula*, toothless).—The sixth order of mammalia in Cuvier's arrangement, or quadrupeds agreeing in the unimportant charac-

ter of being destitute of front or incisive teeth. It comprehends the *Edentata* proper, viz. ant-eaters, armadilloes, &c. ; and the *Tardigrada* or sloths. Many of the huge tertiary mammals of South America belong to the Edentate order.—See tabulations, "Animal Scheme."

Edingtonite.—So called after its discoverer. A member of the Zeolite family, found implanted in minute crystals on Thomsonite in the Kilpatrick Hills, but very rare.

Edriopthalmous (Gr. *edraios*, sessile, and *opthalmos*, the eye).—Applied to those crustaceans which, like the sandhopper and woodlouse, have immovable sessile eyes; in contradistinction to those which, like the crab and lobster, are stalk-eyed or *Podophthalmous*. The group *Edriopthalma* comprises the amphipods, læmidopods, and isopods.—See tabulations, "Animal Scheme."

Effervéscence (Lat. *effervesco*, I boil or bubble up).—The bubbling, hissing commotion which takes place in fluids when gas is generated and given off with rapidity. The effervescence of a Seidlitz powder, and of limestone under the action of muriatic acid, are familiar examples.

Effloréscence (Lat. *effloresco*, I put forth flowers).—Applied in mineralogy to those saline excrescences which cover certain minerals, like alum-shale, sulphuret of iron, &c., when exposed to the action of the atmosphere. *Efflorescence* is caused by the removal of moisture, just as *deliquescence* is caused by the absorption of it.

Eggs, Fossil.—The eggs of turtles occur in a sub-fossil, or rather in a petrified state in the shore-deposits of Ascension and other islands; those of snakes in fresh-water limestones of comparatively recent origin in Germany; and those of birds (*dinornis* and *epiornis*) in the ancient river-silts of New Zealand and Madagascar. Such remains are termed *Oolithes*, which see.

Eifel.—A district on the Lower Rhine, celebrated in Geology for its recent volcanic rocks, its brown-coal, and other tertiary deposits, as well as for its highly-fossiliferous Devonian and Silurian strata. The subject of papers in the geological journals by Lyell, Scrope, Horner, Hibbert, Hamilton, and others, as to its tertiary phenomena; and the fertile field of research to Sandberger, Roemer, Von Dechen, and others, in its palæozoic aspects.

Eisleben in Saxony; a locality well known for its finely-preserved *palæonisci*, and other fishes peculiar to the Carboniferous and Permian formations.

Elæolite (Gr. *elaion*, oil, *lithos*, stone).—A mineral of the Scapolite family having a dull opalescent or fatty resinous lustre; the *fettstein* or fatstone of Werner. Composition, 45 silica, 32 alumina, 15 soda, 5 potash, and traces of lime, magnesia, and iron peroxide.

Eláterite. — Known also as elastic "mineral-pitch" and "mineral-caoutchouc." A variety of bitumen possessing a certain degree of elasticity, and generally found in the crevices of carboniferous limestone, as in Derbyshire and Fifeshire. On exposure to the atmosphere, elaterite gradually loses its elasticity, and becomes hard and brittle like asphalt. According to Johnston, it consists of about 85 carbon and 13 hydrogen, with traces of oxygen and nitrogen.

E'lberseuth, near Bareuth, in the N.E. of Bavaria; celebrated for its Devonian strata which abound in the shells of *Clymenia* — upwards of thirty species having been found there, and the greater number of them peculiar to the locality.

Eléctrum.—A term of the ancients for argentiferous gold-ore, and still applied to those varieties which contain more than 20 per cent of silver, and of a light brass or bronze-yellow colour.

Element.—A simple substance; one which Chemistry cannot resolve into other component substances. Iron, for example, is a *simple* substance or elementary body; rust of iron, a *compound* consisting of metallic iron and oxygen. Elements are spoken of as *proximate* or *intermediate* and *ultimate.* Thus limestone consists of lime and carbonic acid, these are its intermediate elements; but the lime is still further resolvable into calcium and oxygen, and the carbonic acid into carbon and oxygen—the calcium, oxygen, and carbon, being ultimate elements. Upwards of sixty elementary substances are known to the chemist, and of these all the countless combinations and matters in the mineral, vegetable, and animal world are composed.—See CHEMISTRY, and tabulations, "Chemical Scheme."

Elevating Causes.—Under this head are comprehended those agencies which refer to the operation of volcanoes, earthquakes, and gradually elevating forces. The operations of the volcano and earthquake are sudden and violent, and depend proximately on the presence of subterranean heat; gradual elevation, on the other hand, may arise from slow secular movements in the earth's crust, with the proximate causes of which geologists are yet unacquainted. The elevatory power of the *volcano* is seen partly in the upheaval of portions of the earth's crust into mountain chains and ridges, and partly in the accumulation round some centre of eruption of ejected lava, scoriæ, and other materials. The power of the *earthquake* is manifested both by subsidence and elevation—subsidence, as in the sinking of the Allah Bund at the mouth of the Indus in 1819; and elevation, as in the uprise of the coast of Chili in 1822. *Gradual elevation* manifests itself in such uprises as those of the Scandinavian peninsula (to the extent of some three or four feet in a century), and appears to depend on movements in the earth's mass with which we are yet unacquainted.

Elutriation (Lat. *eluere,* to wash out or cleanse).—In Chemistry and Metallurgy, the process of washing by which the lighter earthy parts are separated from the heavier and metallic.

Elvan—Elvan Courses. — A Cornish name for a felspathic rock or porphyry occurring in dykes in the mining districts of that county.

Elýtra (Gr. *elytron,* a sheath).—The hard crustaceous case or sheath which covers the membraneous wings of coleopterous insects like the beetle; the wing-sheath. The elytra of beetles are found fossil from the coal formation upwards.

Embouchure (Fr.)—The mouth of a river, or that part where it enters the sea.

Emerald (Fr. *emeraude;* Ital. *emeraldo;* Lat. *smaragdus*).—One of the gems, and generally of a rich deep-green colour; the less brilliant and colourless varieties being known as *beryls.* The crystals occur in hexagonal prisms, rarely in columnar aggregates, and usually marked with vertical striæ. The emerald is found either imbedded or in druses in the crystalline rocks, especially in granite, gneiss, mica, and talc-slates. The finest specimens are brought from Peru, but fair varieties have been found in Bavaria, India, and Siberia. According to Vauquelin, who, in analysing the emerald, first discovered the earth *glucina,* the purest specimens consist of 65 silica, 14 alumina, 13 glucina, 2.56 lime, and 3.50 oxide

of chromium, to which last the gem owes its fine green colour.—See BERYL.

Emergence—Emergent (Lat. *emergo*).—Rising out of that by which it was covered; applied to islands and shores gradually rising from the ocean. Emergence and subsidence are contradistinguishing terms.

Emery.—A massive, nearly opaque, greyish-black, or indigo-coloured variety of rhombohedral corundum, consisting of alumina, with a small per-centage of silica and peroxide of iron. It occurs in Spain, the Greek islands, and other localities, and derives its name from Cape *Emeri* in the island of Naxos. Triturated, sifted, and attached to brown paper, it forms the *emery-paper* of the polisher.

E'mydæ (Gr. *emys*, the fresh-water turtle).—Fresh-water turtles or mud-tortoises; a family of chelonian reptiles intermediate between the marine turtles and the land-tortoises. In form they are flatter than the land-tortoises; their toes are longer and webbed, but not so long as those of the marine turtles. Fossil species have been found in the Wealden and Tertiary strata.—See REPTILIA in preliminary tabulations, "Animal Scheme."

Enáliosaúria (Gr. *enalios*, marine, and *sauros*, lizard).—Literally sea-saurians; a group of fossil-reptilians, including the aquatic forms—ichthyosaurus, pliosaurus, plesiosaurus, &c.—See SAURIANS.

Enámel.—In Anatomy, the smooth, hard, glossy substance which in various forms constitutes the outer surface of the teeth; seen also on the scales of the fossil *ganoid* or enamelled-scale fishes.

Encéphalous (Gr. *en*, in, and *kephalè*, the head).—Applied to those mollusca which, like the limpet and periwinkle, have a distinct head. The division *Encephala* comprehends the cephalopods, gasteropods, and pteropods; in other words, all the univalves.—See ACEPHALOUS.

E'ncrinite, Encrinítes (Gr. *krinon*, a lily).—The original and general term for the *Crinoidea* or lily-like echinoderms—an extensive and chiefly fossil class, characterised by their long many-jointed stalks, surmounted by lily-shaped bodies or receptacles which were furnished with numerous finger-like rays capable of closing and expanding. The internal calcareous skeletons of the encrinites (in scattered joints and fragments) are so abundant in some carboniferous limestones as to compose the greater portion of the mass; hence the term *encrinal* or *encrinital limestone*. The minuter joints of the fingers and rays are usually termed *entrochi* or wheel-stones, and these, when abounding in certain limestones, confer on them the title *entrochal limestones*. The stalk having been perforated by a canal which kept the whole in vital union, the separated joints present a bead-like appearance; hence such familiar terms as "St Cuthbert's beads" and "wheel-stones" for the solid pieces; and "pulley-stones" and "screw-stones" for their hollow casts in limestones. It is usual, in a general way, to apply the term ENCRINITES to the genera having rounded stalks, and PENTACRINITES to those which are angular or pentangular.—See CRINOIDEA.

Endo— (Gr. *endon*, within).—A common prefix in Geology, as well as in other of the natural sciences; as *endo-gens*, plants increasing in growth from within; *endo-siphonites*, a genus of fossil cephalopods having the siphuncle placed at the inner side of the whorls, &c.

E'ndocarp (Gr. *endon*, within, and *karpos*, fruit).—The stone or shell which, in fruits like the peach and cherry, encloses the embryo or kernel;

the outer skin being the *epicarp*, and the fleshy edible substance the *sarcocarp*.

E'ndogens (Gr. *endon*, within, *ginomai*, I am formed).—That division of the vegetable kingdom whose growth takes place from within, and not by external concentric layers as in the *Exogens*. See MONOCOTYLEDONOUS, and tabulations, "Vegetable Scheme."

Endogenítes.—Fossil stems and fragments exhibiting the endogenous structure are so termed. "It is merely," says Brongniart, "a provisional assemblage of objects to be further examined."

Endosiphonítes (Gr. *endon*, within).—A synonym of Prof. Ansted's for the nautiloid shell *clymenia*, whose siphuncle is on the inner side of the whorls, therein differing from the ammonite, whose siphuncle is on the outer side or dorsal, and from the nautilus, in which it is central.

E'nsiform (Lat. *ensis*, sword, and *forma*, likeness). — Sword-shaped; straight, flat, and pointed, like the leaf of the iris; slender and more tapering forms being *lanceolate;* and those less or more recurved *falciform*.

Entómolite (Gr. *entoma*, insects, and *lithos*, stone).—The general term for a fossil insect, or any part or fragment thereof.

Entomolíthus paradoxus (Gr. *entoma*, insects).—The term given by the earlier palæontologists to the trilobite, which was long confounded with insects in consequence of the segmented aspect of its body.

Entomólogy (Gr. *entoma*, insects, and *logos*, reasoning).—The science of insects; that branch of natural history that treats of the history and habits of insects. *Entomological*, pertaining to the science of insects; *Entomologist*, one devoted to the study of insects.

Entomóphagous (Gr. *entoma*, insects, and *phago*, I devour).—Insect-eating; applied to those animals which chiefly subsist on insects. Same as *Insectivorous*, which see.

Entomóstraca (Gr. *entomon*, insect, and *ostrakon*, shell).—Literally "shelled-insect;" an extensive sub-class of crustacea, generally of small size, covered with a delicate skin, and usually protected by a broad shield or sort of bivalve shell. The branchiæ, when present, are attached to the feet, which, with the antennæ, are generally furnished with bristles that render them efficient organs of locomotion. Occur recent, and fossil in all formations, as *cypris, ceratiocaris, dithyrocaris*, &c. See CRUSTACEA in preliminary tabulations.

E'ntrochi, Entrochítes, and **Trochítæ** (Lat. *trochus*, a wheel).—Names given to the wheel-like joints of the encrinite, which are frequently scattered in great profusion through certain limestones; hence *entrochal marble*. See *Screw-stones, Pulley-stones*, and *St Cuthbert's beads*.

Envelope (Fr. *envelopper*, to roll or wrap up).—A wrapper; a cover; any investing integument; applied to superficial soils, clays, and gravels that mask or cover up the subjacent rocky strata.

Eocene (Gr. *eos*, the dawn, and *kainos*, recent).—A term introduced by Sir Charles Lyell to designate the lower tertiary strata, from the idea that the very small per-centage of living testacea contained in these strata (according to Deshayes only 3½ per cent) indicates what may be regarded as the *dawn* or commencement of the existing or current condition of creation.—See TERTIARY SYSTEM.

Eólian (*Eolus*, the god of wind).—A term given by Nelson to loose material, (sand and the like) drifted and arranged by the wind. As we have *aqueous*

formations, so we may have *eolian* or *sub-aërial,* which is the term most frequently employed.

Epi (Gr. *epi,* upon).—A prefix adopted from the Greek, and having, as the case may be, the signification of *upon, over, outer, all through, besides.*

Epicarp (Gr. *epi,* and *karpos,* fruit).—The outer skin or husk of certain fruits; the fleshy or edible portion being the *sarcocarp,* and the stone the *endocarp.*

Epidérmis (Gr. *epi,* and *derma,* the skin).—The outer-skin, scarf-skin, or cuticle. Used in many branches of natural history, as in Conchology, to the membranaceous horny cuticle that covers many shells; in Botany, to the membrane or outer bark that covers the stems of plants; and in Zoology, to the pellicle or scarf-skin that covers the true skin of animals. In general the epidermis can be peeled or rubbed off without injury to the underlying parts, and in many instances it peels and falls off with the increasing size and age of the plant or animal.

E'pidote (Gr. *epi,* and *didomai,* I give or add to).—A member of the Garnet family, known also as *prismatic augite-spar, pistacite,* and *Arendhalite;* and said to derive its name from its crystals, which always appear horizontal-prismatic, but are prolonged (or added to, *epididomai*) at the base of the prism in one direction. It is generally of a green or greyish colour, and occurs regularly crystallised in druses, or in granular, prismatic, and fibrous concretions. It is found in granite, diorite, and other crystalline rocks, and has many sub-species or varieties, as *zoisite, Thallite, Bucklandite, manganese-epidote,* &c. It consists of 38 silica; 28 alumina; 14 lime; 17 peroxide of iron, and traces of manganese and magnesia.

Epigastric (Gr. *epi,* and *gaster,* the belly).—Belonging to the upper portion of the belly, or epigastric region.

Epímera (Gr. *epi,* and *meros,* a part or portion).—Those parts of the segment of an articulate animal which lie immediately above the joint of the limb; *e.g.,* the *epimera* or side-segments of the lobster.

Epiphyte (Gr. *epi,* and *phyton,* a plant or shoot).—A term for those plants which grow upon others, adhering to their bark, and rooting among the decaying portions of their epidermis. Generally restricted to those orchids that grow upon trees.

Epoch (Gr. *epochê,* a pause in the reckoning of time).—A term literally signifying a stop or fixed point of time from which succeeding years are numbered, but somewhat loosely used in Geology as synonymous with age or era; as the "Silurian epoch," "epoch of gigantic reptilians."

Equátor (Lat. *æquus,* equal).—The great circle on the earth's surface, every point of which is equally distant from the poles; such a circle cuts the globe into two equal parts or halves,—in other words, into *hemispheres,* viz., the Northern and Southern. When the sun is in the line of the equator, day and night are of equal duration, hence it is also termed the equinoctial line (*nox* the night).

Equatórial.—Belonging to, or in the region of the equator; as the "equatorial diameter" of the earth; the "equatorial current" of the Atlantic.

Equi (Lat. *æquus,* equal).—A common prefix in scientific terminology signifying equal or alike, as *equi-distant,* equally distant; *equi-lateral,* equal-sided; *equi-valved,* having both valves alike.

E'quidæ (Lat. *equus,* a horse).—The Horse tribe; the family of solidungulous pachyderms, having only one apparent toe and a single hoof to each

foot. It includes the horse, ass, zebra, &c., and members of the family occur fossil in the middle and upper tertiaries.

Equine (Lat. *equus,* a horse).—Pertaining to the horse; belonging to the Horse family.

Equisetáceæ (Lat. *equus,* a horse, and *seta,* a hair or bristle; whence the English name *horsetail*).—An extensive order of marsh or boggy cryptogams or flowerless plants, well represented by the common "horsetail" of our bogs and ditches. They occur in every region from Lapland to the equator, but acquire their greatest magnitude and abundance in moist warm regions. They are also found fossil in all formations, the most gigantic specimens occurring in carboniferous and oolitic strata. The equisetums are readily distinguished by their erect hollow stems, which are striated and jointed, frequently with whorls of small attenuated leaves at the joints, and all less or more rough from the quantity of silex contained in their cuticle.

Equisetítes (Lat. *equisetum,* the plant horsetail).—Fossil plants resembling the equisetum of our pools and marshes, and found in all formations from the Devonian upwards. In *equisetum* the stems are jointed, and surrounded by closely-fitting cylindrical sheaths, which are regularly toothletted, and which leave their impress on the stems; but the stems are not channeled throughout as in *Calamites,* for which they are apt to be mistaken.

Equívalent.—A term frequently employed by geologists to designate strata or series of strata that have been formed contemporaneously in distant regions, or which, palæontologically speaking, are characterised by similar suites of fossils. Thus the "Keuper" of Germany, and the "Marnes Irisées" of France, are said to be the *equivalents* of the saliferous and gypseous sandstone and marls of Cheshire; the "Calcaire de Caen," or celebrated building-stone of Caen, the equivalent of our Great or Bath Oolite.—See Table of Contemporary or Equivalent Strata, in preliminary tabulations, "Geological Scheme."

Era (Lat.)—In Chronology, a fixed point of time, at which the computation of ensuing years is commenced, as the "Christian Era." In Geology the term is somewhat loosely employed, not only to denote the commencement of a new "system," or "formation;" but the entire duration of that system or formation, as "the plants of the carboniferous era"—"the era of gigantic reptiles."

Erbium.—One of the rarer metals, of which very little is known. According to Mossander, the earth called *yttria* is a mixture of the oxides of three metals—*yttrium, erbium,* and *terbium,* which differ in the character of their salts, and some other particulars.

Eremacaúsis (Gr. *eremê,* slow, and *kausis,* burning).—Slow-burning; decay. Liebig's term for that slow chemical change brought about by the action of the oxygen of the atmosphere on moist organic bodies, by which they are consumed or burnt without any sensible increase of temperature; *e.g.,* the conversion of vegetable substances into humus.

Erinite (*Erin,* the ancient name of Ireland).—The name given by Haidinger to a beautiful green arseniate of copper (59.5 protoxide of copper, 33.5 arsenic acid, 5 water, and 2 alumina), from its being found in the county of Limerick, in Ireland. Also the name given by Thomson to a dull brownish-red variety of bole found near Antrim, and which consists of 47 silica, 18.5 alumina, 6.5 iron peroxide, 25 water, with traces of lime, salt, and magnesia.

Erósion (Lat. *erosus,* gnawed or worn away).—The act of gradually wearing away; the state of being gradually worn away, *e.g.,* "Valleys of erosion," or those valleys which have been gradually cut out of the solid strata by the long-continued action of the river or rivers that flow through them. Most of the ravines and glens and river-channels in the British Islands are the results of *erosion;* for, whatever inequalities of surface may have originally directed the waters into their channels, all the subsequent deepening, and scooping out, and widening of the valleys, have been owing to the erosive force of running water laden with sand, gravel, and other triturating debris.

Erpetólogy (Gr. *erpetos,* reptile, and *logos,* reasoning).—That branch of natural science which treats of the structure, habits, and history of reptiles.

Erratic Block Group.—A synonym of the boulder clay, so called from the large transported blocks which are thickly strewn through it. "*Erratics,*" a brief term applied to the blocks themselves.—See PLEISTOCENE and DRIFT FORMATION.

Eructation (Lat. *eructatio*).—A violent bursting forth of gaseous and liquid matter from any orifice or opening, as from the water of a volcano or geyser.

Eruption (Lat. *e,* out of, and *ruptus,* burst forth).—A violent and forcible breaking out of enclosed matters; as the outburst of lava, ashes, mud, hot water, or steam from an opening in the earth's crust.—**Erupted,** forcibly thrown forth, as stones, scoriæ, &c., from the crater of a volcano. —**Eruptive,** applied to such igneous rocks as have evidently burst through the sedimentary strata, in contradistinction to those which have greatly overflowed, and become *interstratified.*

Escárpment (Fr. *escarper,* to cut steep).—The abrupt face or cliff of a ridge or hill-range.

Esócidæ (Lat. *esox,* the pike).—The Pike family; represented by the well-known fresh-water fish of that name. The pikes are extremely voracious fishes, and for this purpose have their mouths abundantly armed with formidable teeth. Fossil species are said to occur from the Chalk period upwards.

Esóphagus or **Œsophagus** (Gr. *oïo, oiso,* I carry, and *phago,* I eat.)—The canal through which the food passes (or is carried) from the mouth to the stomach.

E'stuary (Lat. *æstus—æstuo,* I boil—the tide; so called from the troubled boiling up of the water-line, which marks its approach in river-mouths).—Estuaries are, properly speaking, tidal river-mouths, like those of the Thames, Severn, Solway, &c.; whose fauna and flora are mixed fresh-water and marine, or composed of such species as are peculiar to brackish waters. From these peculiarities, the geologist is enabled to determine that certain formations, such as the Wealden, have been deposited in estuaries, and not in fresh-water lakes, nor in the open ocean; and hence also the frequent use of such phraseology as "estuary limestones," "estuary mudstones," and the like.

Ethmoid (Gr. *ethmos,* a sieve, and *eidos,* like).—Sieve-like; perforated like a sieve. Generally applied to the bone of the nose, which is perforated like a sieve, for the passage of the olfactory nerves.

Etíolate (Fr. *etioler*).—In gardening, to grow up long-shanked and colourless; to blanch or make white, by concealment from the light. The inner leaves of lettuce and cabbages become *etiolated* by exclusion from

the light; and the blanching or *etiolation* of celery is produced by earthing up, so as to exclude the actinic or colouring effect of the sun's light.

Eúchroite (Gr. *eu*, well, and *chroa*, colour).—An arseniate of copper of a fine green colour; hence the name.

Eúclase (Gr. *eu*, easily, and *klasis*, fracture).—The prismatic emerald of Mohs; a very rare mineral, found chiefly in Brazil and Peru, in transparent crystals of a pale bright green colour. It consists, according to Berzelius, of 43.22 silica, 30.56 alumina, 21.78 glucina, with the oxides of iron and tin. Its form is an oblique prism, variously modified. It is characterised by great brittleness (whence its name), the facility with which it becomes electric by heat, and the length of time it retains this property. These characters distinguish it from the true emerald and beryl; and its brittleness prevents its being employed as a gem.

Eúdialite (Gr. *eudios*, serenely clear, and *lithos*).—The rhombohedric almandine-spar of Mohs, one of the Haloid family. A rare mineral from Greenland, occurring in octahedral crystals of a soft reddish-lilac or hyacinthine colour, and containing zircon with silica and soda. It much resembles *almandine* or noble garnet, but is distinguished by its crystalline form, its lower specific gravity, inferior hardness, and action under the blow-pipe.

Euélephas (Gr. *eu*, well, and *elephas*).—Founding chiefly on their dentition, Dr Falconer proposes to divide the Elephants into three sub-generic groups—the *Stegodons*, the *Loxodons*, and the *Eu-elephants*—the latter term having reference to the typical elephants most familiarly known.—(*Geol. Journal*, vol. xiii.)—See STEGODON, &c.

Eukairite (Gr. *eukairos*, convenient, well-situated).—A cupreous seleniaret of copper, found disseminated in the calcareous rocks of Smoland in Sweden. Consists of 39 silver, 26 selenium, 23 copper, and 8 alumina.

Eunótia (Gr. *eu*, well, and *notus*, back).—A genus of Diatoms or microscopic plant-growths, having a siliceous simple or bivalve shield, flat below and convex, and often richly dentated above; whence the name. Occurs fossil in the mountain-meal of Santa-Fiora, and in similar accumulations.

Euómphalus (Gr. *eu*, well, and *omphalos*, navel).—A whorled discoidal shell, ranging from the Lower Silurian to the Trias inclusive, but specially abundant in the carboniferous limestone. In the euomphalus, which belongs to the family Turbinidæ and order Gasteropoda, the whorls are angular or coronated, the aperture polygonal, the umbilicus very large, and the shell frequently of gigantic dimensions.

Euphorbítes.—Artis' term for the *sigillaria pachyderma*, from its supposed affinity to the Euphorbias.

Eúphotide (Gr. *eu*, well, and *phos*, *photos*, light).—A crystalline rock consisting essentially of Labrador felspar and diallage, with subordinate intermixtures of hornblende or augite. So called from irridescent lustre or quality of reflecting light. The *Gabbro* of the Italian artists.

Eurite.—The whitestone or weiss-stein of Werner. A term of the French mineralogists for a variety of granite in which felspar predominates so as to give it a uniform white colour; generally small-grained with a few crystals of quartz, and occasional scales of white silvery mica; sometimes porphyritic from the interspersion of larger crystals of felspar.

Eurynótus (Gr. *euros*, breadth, and *notos*, the back).—Literally "broadback;" a genus of Lepidoid fishes occurring in the carboniferous formation, and differing from *Palæoniscus*, with which they were at one time united, in

their high bream-like back, stronger crenulated scales, and generally larger size.

Eurýpterite.—A convenient Anglicised term for any of the Eurypterus family, or for any undetermined portion or specimen thereof. Introduced to harmonise with Trilobite; hence we speak of the *trilobites* of the Silurian and the *eurypterites* of the Devonian epoch.

Eurýpterus, Eurypteridæ (Gr. *euros*, breadth, and *pteron*, wing or fin).—A genus and family of extinct crustaceans, ranging from the Upper Silurians to the Lower Coal-measures inclusive, and so termed in allusion to their broad oar-like swimming feet. The family embraces *eurypterus* proper, *pterygotus*, and others—all characterised by their long lobster-like forms, which consist (in the dorsal aspect) of an oblong-oval cephalothorax or carapace, with marginal or sub-central eyes; eleven abdominal or thoracico-abdominal segments, free and devoid of appendages; and a telson or tail-plate more or less elongated, and usually pointed. The carapace (in the oral or ventral aspect) is furnished with three pairs of five- or six-jointed members—the two first variously formed in the different genera (some furnished with spines, others with prehensile pincers), and the posterior forming the broad swimming feet which give name to the family. The oral apparatus consists, as in the King-crab, of the serrated basal joints of the limbs, and is protected by a broad heart-shaped metastome or mouthpiece. In all the genera the exterior crust is ornamented with a peculiar scale-like sculpture, which becomes bolder and stronger on the free or exposed margins.——The relations of the Eurypteridæ to other crustacean families are by no means well determined, and geologists must in the mean time rest satisfied with mere hints as to affinities with Copepods, Pœcilipods, and other existing orders. —See PTERYGOTUS, CRUSTACEA, and tabulations, "Animal Scheme."

Evaporation (Lat. *evaporo*, I send off in vapour).—The act of converting into vapour such liquids as water, either by natural or by artificial means, the former being termed "*spontaneous evaporation*." Heat is the grand evaporating agent in nature, and its effects are greatly facilitated by the removal of the vapour as soon as it is formed either by currents of wind, by absorption, or by other analogous means.—See VAPOUR.

Excavation (Lat. *ex*, out of, and *cavus*, hollow).—Any cavity or hollow, whether natural or artificial. Rocks are *excavated* naturally by the action of waves, by subterranean springs, by rivers, and other currents of water.

E'xcrement (Lat. *excrementum*).—That which is separated from the food after digestion, and ejected from the body of animals by the intestinal canal. *Excrementitious* or fæcal matter is found abundantly in a fossil state, and known as *coprolite*, which see.

Excréscence (Lat. *ex*, out of, and *cresco*, I grow).—Any body or substance growing upon, or out of another, in an unusual manner; any preternatural growth of a substance, mineral or organic.

Excrétion (Lat. *excretus*, thrown out of, separated).—The act of separating or voiding excrementitious matter from the blood and food; also the substances excreted, as perspiration, fæcal matter, &c.

Exfóliate (Lat. *ex*, from off, and *folium*, a leaf).—To separate or fall off in laminæ or scales. *Exfoliation*, by weathering, is very perceptible in some varieties of greenstone which disintegrate, coating after coating (leaf after leaf), till the whole of the rock-face looks like a pile of concentric concretions in various stages of decay.

Exhalation (Lat. *exhalatio*, a breathing out of).—Any vapour or gaseous matter arising from substances or surfaces exposed to the atmosphere; as the "sulphurous exhalations" from a volcanic crater, the "poisonous exhalations" or miasm from a putrid bog or fen.

Exogenítes.—Any fragment of fossil wood exhibiting the exogenous structure, and otherwise of unknown affinity, is so termed.

E'xogens (Gr. *exo*, without, and *ginomai*, I am formed).—That division of the vegetable kingdom whose growth takes place by external concentric layers of annual increment, like the beech, ash, elm, &c., in contradistinction to the *Endogens*, or those whose growth is not indicated by concentric layers.—See DICOTYLEDONOUS, and tabulations, "Vegetable Scheme."

Exogýra (Gr. *exo*, outward, and *gyros*, a twist or turn).—The subgeneric term employed by Sowerby and others to designate the Chama-shaped species of *Gryphæa* having the umbones sub-spiral, and turned outwards or towards the posterior side. These shells are now usually included in the wider genus Gryphæa, though some still retain *gryphæa* and *exogyra* as sub-genera of the more typical genus *Ostrea* or oyster.

Exótic (Gr. *exotikos*, thence, from a strange country).—In Botany, applied to plants not natives of the countries in which they are cultivated; the opposite of *Indigenous.*

Expansion (Lat. *expansus*, spread out).—The increased bulk which bodies assume when heated. All substances, solid as well as liquid, when chemical change does not take place, expand by heat and contract by cold. Water presents an apparent exception to this rule, inasmuch as it attains its minimum volume at 40°, expands and is converted into steam above this temperature, and also expands as it falls below it, till converted at 32° into ice, a solid crystalline mass, which being lighter (or occupying a larger volume) floats on the surface. Clay also, from its losing its water of plasticity, shrinks or contracts by heat; but such contraction applies to the compound mass only—not to separate substances *per se.*

Explosion (Lat. *explosio*).—The sudden and violent expansion of any object, by which its constituent parts are burst asunder. *Explosion* differs from *expansion* inasmuch as it is always sudden and of momentary duration, whereas the latter is gradual, and more or less continuous. Explosion is also for the most part accompanied by chemical change; expansion, on the other hand, is mainly mechanical. Explosion has reference chiefly to gaseous substances; expansion, to solids and liquids.

Exsiccátion (Lat. *ex*, out of, and *siccus*, dried up).—The drying up of solid bodies; the expulsion of moisture from their structure by heat, by pressure, or by any other means.

Exúviæ (Lat., cast clothes).—In Zoology this term is applied to the moulted or cast-off coverings of animals, such as the skin of the snake, the crust of the crab, &c.; but in Geology it has a somewhat wider sense, and applies to all fossil animal matter or fragments of whatever description.

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Faboídea (Lat. *faba,* a bean).—A term applied by Mr Bowerbank to certain bean-shaped leguminous seeds found in the London, or lower tertiary, clays of the Isle of Sheppey.

Face.—In Crystallography, one of the planes which form the surface of a regular solid. A cube has six such "faces," or plane surfaces.

Facét (Fr. *facette,* a little face).—Applied to the small terminal faces of crystals and cut gems. Precious stones cut into numerous faces are said to be *facetted,* in contradistinction to being polished into rounded forms, or cut, as lapidaries term it, "*en cabochon.*"

Fácies (Lat.)—A convenient term in Natural History, introduced to express any common resemblance or aspect among the rocks, plants, animals, or fossils of any area or epoch. Thus we speak of the "facies of the Carboniferous flora" as distinct from the floras of other epochs; and of the "facies of the Australian fauna" as distinguished from the animals of other regions by their common marsupial characteristics.

Factítious (Lat. *factus,* made).—Made or fashioned by art in contradistinction to that formed by nature. We have thus factitious waters and factitious stones made to resemble the natural products.

Fæces, Fæcal (Lat. *fæx,* pl. *fæces,* excrement, worthless sediment).—The fossil fæces of fishes, saurians, &c., are known as *coprolites;* the hardened excrement of dogs and wolves, *album græcum;* that of mice, *album nigrum.* The preservation of *fæcal* matter is common in all the geological formations.

Fáhlore, Fáhlerz (Ger. *fahl,* ash-coloured, and *erz,* ore).—The mineralogical term for "grey copper-ore," and the type of a family of minerals containing that important metal.—See tabulations, "Mineral Scheme."

Fáhlunite.—A sub-species of octahedral corundum, found in talcose rocks at Fahlun in Sweden; hence the name.—See AUTOMALITE.

Faikes or **Fakes.**—A Scotch miner's term for fissile sandy shales, or shaly sandstones, as distinct from the dark bituminous shales known as "blaes" or "blaize."

Fairy-stone.—A name given by the peasantry in the south of England to the flinty fossil sea-urchins found in the Chalk; also a term used by geologists for recent concretions of hardened clay or clay-ironstone occurring near the sources of certain chalybeate springs.

Fálcate, Falcated (Lat. *falx, falcis,* a reaping-hook).—Sickle-shaped, bent, or shaped like a reaping-hook.

Fálciform (Lat. *falx,* a reaping-hook, and *forma*).—Shaped like a scythe or reaping-hook; *e.g.,* certain bivalves and fish-spines.

Falling-stones.—A familiar term for aërolites or meteoric stones, which see.

Faluns.—A French provincial term for the shelly tertiary strata of

Touraine and the Loire, which resemble the "Crag" of Norfolk and Suffolk.

Family. — In Natural History classifications this term denotes the group next in value and comprehensiveness above the *genus*. As species constitute a genus, so genera constitute a family. The word, however, is often used in a loose and general way, as equivalent to kind, tribe, or group.

Farína (Lat. *far*, corn).—Meal or flower, obtained by grinding and sifting wheat or other corn.—**Fossil Farina,** a mealy-looking infusorial or microphytal earth—the *Berg-mahl* of the Swedes and Laplanders.

Fascícular (Lat. *fasciculus*, a little bundle).—United or growing together in bundles or tufts, as the needle-shaped crystals of some of the zeolites, or the leaflets of the larch, pine, and other coniferæ.

Fasciculária (Lat. *fasciculus*, a cluster or little bundle).—A genus of polyzoa occurring in the Coralline Crag of Suffolk, and so named from its clustered or globular form. It belongs to the family of *Tubuliporidæ*.

Fascioláría (Lat. *fasciola*, a swathing band or stripe).—A genus of gasteropods belonging to the family *Muricidæ*, and so termed from the smooth band-like surface of their windings. They are thus distinguished from *Murex*, whose windings are rough with "varices" or wrinkle-like swellings, and from *Fusus* by their spirally-plaited columella. The existing species are found chiefly in warm and southern seas; the fossil occur in the Chalk and upper Tertiaries.

Fássaite.—A variety or sub-species of Augite, occurring in fine sharp crystals of high lustre, and dark or pistacio-green colour, in traps, altered limestones, and magnetic ores. It derives it name from *Fassathal*, in the Tyrol, where it is found in great perfection.

Fault.—The term for any fissure accompanied by a displacement of the strata on either side. On one side the strata may be *thrown down* many fathoms, on the other, *thrown up;* and at the same time may be altered in their dip or inclination. Strata so fissured and displaced are said to be "*faulted*." *Slip, slide, heave, hitch, throw, trouble,* and the like, are familiar and synonymous terms.—See THROW.

Fauna (Lat. rural deities).—A convenient term for the animals of any given epoch or area; *e.g.*, the "fauna of South America," the "fauna of the Permian Era." As the Animals of an area or epoch constitute its FAUNA, so the plants constitute its FLORA.

Favosítes (Lat. *favus*, a honeycomb).—A genus of sessile-spreading corals common to the Silurian, Devonian, and Carboniferous systems; and so called from the regular polygonal arrangement of their pore-cells.

Favulária (Lat. *favosus*, honeycombed).—A genus of coal-measure stems, so called from the aspect of their leaf-scars, which resemble in closeness and regularity the arrangement of a honeycomb. The *Favularia* have furrowed stems, with square-shaped leaf-scars on the ridges—the scars being of a breadth with the ridges. The stems seem to have been clothed with a densely imbricated foliage, the leaves running in parallel rows, which were separated by narrow intermediate furrows.

Félidæ (Lat *felis*, a cat).—The Cat kind; a family of carnivorous mammalia, characterised, like the lion, tiger, cat, &c., by their short powerful jaws, retractile claws, and the peculiar adaptation of their teeth for cutting (trenchant). Geologically, the felidæ are of recent origin, their remains

not occurring prior to the pleistocene cave-period; *e.g.*, the *Machairodus.* —See tabulations, "Animal Scheme."

Félspar (Ger. *feldspath*, rock-spar).—An important rock-constituent or simple mineral, consisting essentially of silica and alumina, with potash or soda, and traces of lime, magnesia, and peroxide of iron. It is the representative of a family—the *Felspar Family*—whose species enter largely into the composition of all igneous rocks—granite, porphyry, greenstone, and trachyte. It occurs crystallised, disseminated, massive or amorphous; is colourless, but usually of shades of greyish-white, reddish, yellow or green; when crystallised, breaks into rhomboidal fragments, whose flat surfaces have a peculiar pearly-vitreous or resino-vitreous lustre; and its crystals have a hardness about 6, with a specific gravity varying from 2.5 to 2.75. In ordinary granite it is readily distinguished from the quartz, with which it is associated, by its flat lustrous fracture, and by its being scratched by the knife while the quartz resists it. The more abundant and better-known species are *Orthoclase* or potash-felspar, with its varieties adularia, common felspar, glassy-felspar, and felstone or compact felspar; *Albite* or soda-felspar, known also as Cleavelandite; *Labradorite, Oligoclase,* and *Amorphous felspar,* with its varieties obsidian, pumice, pearlstone, and pitchstone—all of which are noticed under their respective names. Mineralogically and geologically, the felspars are most important minerals, and industrially they have also their value—some, as adularia, being used by the lapidary; others, as common felspar, for enamels, artificial teeth, and the like; and the decomposable varieties yielding in nature the finest *kaolin*, or china-clay, to the potter. Mineralogically, the interchanges of soda, potash, and lime, in the several varieties, are curious and instructive; and geologically, the fact that potash abounds in the more siliceous felspars of the older Plutonic rocks, whereas soda and lime prevail in the less siliceous or volcanic, is not without its significance and value. The following exhibits their range of composition, and consequently accounts for their varying external or physical characteristics:—

	Silica.	*Alumina.*	*Potash.*	*Soda.*	*Lime.*	*Iron.*
Orthoclase...	64—70	15—20	7—14	1—4	1—3	1—2
Felstone ...	71—80	11—15	4—7	...	0—1	1—2
Albite	67—71	14—20	1—4	7—11	1—3	0—1
Labradorite.	48—55	26—30	0—1	1—4	9—12	1—3
Anorthite ...	42—46	32—37	0—1	0—1	10—18	0--1
Oligoclase ...	60—64	18—24	1—3	2—10	2—5	0—1
Obsidian ...	72—84	4—11	6—10	3—5	1—4	1—3
Pumice	70—77	12—18	0—4	0—4	2—4	1—4
Pitchstone...	66—76	8—14	...	2—6	2—5	1—4

Felspáthic.—Of the nature of felspar; containing felspar. Any mineral or rock in which felspar greatly predominates is said to be felspathic; as, "felspathic claystone," "felspathic greenstone," &c.

Fenestélla (Lat. a little window).—An extensive genus of polyzoans, resembling the *retepora* or *flustra* of existing shores, and found in all the palæozoic strata, from the Silurian upwards. In fenestella the cells are very small, indistinct externally, with minute prominent openings; and the polypary or cœnœcium composed of branches which unite by growth and form a cup.

Fermentation (Lat. *fermentatio*).—The spontaneous decomposition of the proximate principles of organic bodies, under the joint influence of *warmth, air,* and *moisture,* and the reunion of their elements forming new compounds; *e.g.*, the conversion of the expressed juice of the grape into wine, or a solution of malt into alcohol or spirit. The simplest case of fermentation is that of *must,* or the expressed juice of the grape, which, when exposed, either in close or open vessels, to a temperature of about 70°, soon begins to give off carbonic acid, and to become turbid and frothy; after a time a scum collects upon the surface, and a sediment is deposited; the liquor, which had grown warm, gradually cools and clears, loses its sweet taste, and is converted into *wine.* This is the "vinous fermentation;" but if the wine be further exposed to air, and a due temperature, a second fermentation ensues, which is called the "acetous fermentation," and which terminates in the production of *vinegar* or *acetic acid.* In other words, the oxygen of the air converts the hydrogen of the alcohol—alcohol consisting theoretically of carbon, water, and hydrogen—into water, and leaves in the acetic acid an indestructible or permanent residue of carbon and water only. *Fermentation,* or *putrefaction,* thus differs from *eremacausis,* or *decay,* in being limited to changes occurring in and beneath the surface of water, the effect being a mere transposition of elements or a metamorphosis of the organic body. Eremacausis, on the other hand, refers to the decomposition of moist organic matter, when freely exposed to the air, by the oxygen of which it is gradually burned and destroyed, without any sensible elevation of temperature. In the economy of nature as well as in the arts of life, fermentation or putrefaction is an agency of the highest interest and importance. "Like the labours of a scavenger," says Dr Cooley, from whom we abridge, "it speedily removes from the surface of our globe those matters which would otherwise remain for some time without undergoing decomposition. It either dissipates in air, or reduces to more fixed and useful forms of matter, those organic substances which by their presence would prove noxious, or at all events useless, to the animal and vegetable kingdoms. It is the great power that cleans the Augean stable of nature, at the same time that it provides some of the most esteemed articles of utility and luxury (the fermented liquors, &c.) for the well-being and enjoyment of man."

Ferríferous (Lat. *ferrum,* and *fero,* I yield).—Applied to veins, strata, and other matrices that yield or contain iron.

Ferrúginous (Lat. *ferrum,* iron).—Impregnated or coated with oxide of iron; rusty-looking.

Féttstein (Ger. fat-stone).—Same as *elæolite* (oil-stone) or nepheline. One of the Scapolite family, so called from its fatty or resinous lustre. Consists of silica 45, alumina 32, soda 15, and potash 5, with traces of lime, magnesia, iron, and water.

Fíbrolite.—A term occasionally applied to the fine fibrous varieties of Andalusite. They consist of from 38 to 46 silica, 50 to 58 alumina; and .75 to 2.5 iron peroxide; and are known also by the name of *Bucholzite.* —See ANDALUSITE.

Fíbrous (Lat. *fibra,* a thread or fibre).—Applied in Geology and Mineralogy to rock and mineral textures which consist of or resemble fibres, as amianthus or asbestos.

Ficoidítes (fig-like).—The generic term used by Artis, in his "Antediluvian Phytology," for the *Stigmaria ficoides,* which see.

Fíguline (Lat. *figulus*, a potter, from *fingo* I fashion).—A term occasionally applied by mineralogists to potter's clay.—See CLAY.

Figure-Stone.—A variety of talc-mica or steatite; known also as *Agalmatholite.* Its usual colour is white or red, or both colours intermingled in bands and patches. The finest are brought from China, where it is cut into various figures, pagodas, &c.; hence the names *figure-stone, pagodite,* and the like.

Fílices (Lat. *filix,* a fern).—In Botany, the fern-tribe—the *Filicales* or Filical Alliance of Lindley.—See tabulations, "Vegetable Scheme."

Filicítes (Lat. *filix,* a fern).—Sclotheim's generic term for the fern-like plants now called *neuropteris* and *pecopteris;* used also as a general term for any fossil fern or filicoid plant.

Fílicoid (Lat. *filix,* fern, and *eidos,* likeness).—Applied to plants, recent or fossil, which resemble or partake of the nature of the fern-tribe.

Fíliform (Lat. *filum,* a thread).—Thread-like; slender as a thread.

Filtration (Lat. *filtrum,* an instrument for straining liquids).—The separation of liquids from substances mechanically suspended in them, by passing them through the pores of media sufficiently fine to keep back the particles of solid matter. Gravel, sand, sandstone, and other porous strata, are the great filtering media in nature.

Fíorite.—Pearl-sinter; a variety of siliceous sinter found incrusting volcanic tufa at Santa Fiora in Tuscany, whence the name. It is not uncommon in the vicinity of hot springs and volcanoes, and consists chiefly of silex, with a little alumina, iron-peroxide, and water.

Fire-Clay.—Any clay capable of resisting a great heat without slagging or vitrifying. This property arises from the absence of any alkaline earth to act as a flux. Fire-clays abound in the coal-measures of Great Britain, and are largely employed in the manufacture of furnace and grate bricks, retorts, chimney-flues, and the like. The celebrated Stourbridge clay (Worcestershire) is said to consist of about 64 silica, 24 alumina, and 2.0 oxide of iron—the rest being water and traces of carbonaceous matter.

Fire-Damp.—A miner's term for light-carburetted hydrogen, which, when diffused in the atmosphere of the coal-workings to the amount of one-thirteenth by volume, becomes explosive.—See AFTER-DAMP and CHOKE-DAMP.

Fire-Opal, or Girasol, a fine lustrous variety of Opal, which see.

Fire-Stone.—Any stone that stands heat without injury; generally applied to certain cretaceous and oolitic sandstones employed in the construction of glass furnaces. In geological classification, a calcareo-arenaceous member of the Upper Greensand, so called from its yielding stone of this description.

Físsile (Lat. *fissilis*).—Capable of being split; applied to rocks which, like clay-slate, can be split or divided in the direction of the grain or cleavage.—**Fissility,** the quality or characteristic of admitting to be split in thin leaves or laminæ.

Fissure (Lat. *fissus,* split asunder).—A crack, rent, or open crevice in rocks; strata or rock-masses so rent are said to be *fissured.*

Fístulous, Fistular (Lat. *fistula,* a pipe).—Hollow like a pipe; tube-like.—Applied to the stems of grasses, umbelliferous plants like the hemlock, &c.

Fixed Air.—A name formerly given by chemists to carbonic acid gas, from its being the air or gas fixed, as it were, in lime, magnesia, and the alkalies.

Flabellária (Lat. *flabellum*, a fan).—A provisional genus intended to embrace all those broad, flabelliform, palm-like leaves which occur particularly in the Coal-formation and Tertiary lignites.

Flabélliform (Lat. *flabellum*, a fan, *forma*, likeness).—Fan-shaped; applied to the broad spreading leaves of certain palms,—such leaves being found in many lignites as well as in the older coal-formations.

Flagstone.—A quarryman's term for any fissile sandstone which "beds," or splits up into flags, like the Arbroath and Caithness paving-stone.

Flaggy.—Applied to the laminar strata capable of being split up.

Flenú Coal.—A peculiar variety of bituminous coal occurring abundantly in the Belgian coal-fields. It burns rapidly with much flame and smoke, not giving out an intense heat, and having a somewhat disagreeable odour. It resembles some of the seams found at Swansea in Wales.—See COAL FAMILY.

Flints (Sax.)—The familiar as well as technical term for those siliceous nodules and concretions which occur so abundantly in the white chalk of England, in many limestones and other calcareous strata. *Flints* are composed almost entirely of silex, with traces of iron, clay, and lime; and where lime is present in any notable proportion, or when limestones become so siliceous as to be incapable of conversion into quicklime, the admixture is known as *Chert*. In the chalk formation, flints are usually aggregated round some nucleus of sponge, shell, coral, or other organism; and there is little difficulty in conceiving the silex to have been originally in solution in the waters of deposit, and subsequently segregated by some chemical process into layers and nodules as we now behold it. Being so frequently collected round spongiform organisms, it has been ingeniously surmised by Dr Bowerbank, "that the geological office of the Sponges in creation is that of inducing the deposit of siliceous matter held in solution in the ocean, just as the Corals assist in the consolidation of the calcareous matter." Economically, flint is of considerable importance, being largely used (when calcined and ground) in the manufacture of china, porcelain, flint-glass, and the like. It is also employed, in absence of other material, as a building-stone; and before the invention of percussion-caps and lucifer matches, was in universal use for gun-flints and fire production.

Float-Stone (Ger. *Schwimmstein*).—A variety of earthy silica, of a coarse porous aspect, soft and often friable, and of a yellow or greyish-white colour. Being porous, it swims on water till saturated; hence the name, *float-stone* or *spongiform quartz*. According to Ehrenberg it consists chiefly of the siliceous coverings of infusoria, and is thus closely related to *tripoli, polishing-slate*, and other earthy silicas. An analysis by Schaffgotsch gives 85.9 silica, 0.7 alumina, 9.1 carbonate of lime, and 3.3 water.

Flócculent (Lat. *floccus*, a lock of wool).—Applied to solutions or mechanical suspensions of impalpable mineral matter—the particles aggregating in light cloudy "flocks" during the act of deposition.

Flookan or **Flucan.**—A miner's term for a soft clayey substance occasionally found in cross-courses and slides; a cross-course or transverse vein composed of clay. A *cross-flookan* is a slide or fissure filled with clay which runs across a lode and heaves it.

Flora (Lat., the goddess of flowers).—A convenient term for the vegetation of any given epoch or area—as "the flora of the coal-measures"—"the flora of South America." As the plants of a country or epoch constitute its FLORA, so the animals constitute its FAUNA.

Flos-ferri (literally, flower-of-iron).—A fine radiated or coralloid variety of arragonite, common in the iron mines of Styria, and also in some limestone beds. Known also as *Needle-spar;* and differs from *Satin-spar,* which is a fine fibrous silky variety of the same mineral.—See *Arragonite.*

Flötz (Ger.)—A term applied by Werner to the secondary strata, because they were *flötz,* or flat-lying, compared with the primary and transition rocks.

Fluor-Spar (Lat. *fluere,* to flow; so called from being used as a flux).—Fluate of lime, or fluoride of calcium, consisting of 67.75 lime, and 33.25 fluoric acid. It occurs chiefly in veins either crystallised in cubes, foliated, in granular crystalline masses, or compact and earthy. Its colours are various, the more common being violet-blue, honey-yellow, green, and purplish-blue passing into red. Beautiful crystals are found in the lead mines of Alston Moor and Derbyshire, and the concretionary crystalline masses of Castleton in Derbyshire (known as *Blue-John* or *Derbyshire-spar*) are wrought into various ornamental articles.

Flúviatile (Lat. *fluvius,* a running river).—Belonging to a river; produced by river action; growing or living in fresh-water rivers.

Fluvio-marine (Lat. *fluvius,* a river, and *marē,* the sea).—Applied to stratified deposits which seem to own a mixed river and sea origin; in other words, to deposits brought into the sea by river-currents, loaded with the detritus of the land: hence the occurrence in the same beds of terrestrial, fresh-water, and marine remains.

Flux (Lat. *fluere,* to flow).—In Chemistry and Metallurgy, any substance added to facilitate the fusion of metals or minerals. Alkaline fluxes are generally employed; they render the earthy mixture fusible by converting it into glass. Salts of potash and soda, lime, borax, and the like, are well-known fluxes.——In Hydrography, the flow of the tidal wave—the Flux being the rise, the Reflux the ebb of the tide.

Flysch.—A provincial Swiss term for a series of tertiary strata consisting of dark-coloured slates, marls, and fucoidal sandstones immediately overlying the nummulitic limestone. According to Lyell, the *flysch* occupies a middle place in the Eocene or older Tertiaries.

Foliated (Lat. *folium,* a leaf).—Resembling a leaf; composed of thin leaf-like layers. Thus certain shells are said to be *foliated,* when their surfaces are covered with leaf-like projections, as the rose-bush murex; the substance of a shell is also said to be foliated when composed of thin flat layers overlapping each other, as in the oyster; and we speak of *foliated gypsum,* when the texture is scaly or leafy, and not granular or compact.

Foliation (Lat. *folium,* a leaf).—In Botany, the manner in which the young leaves of plants are arranged in the leaf-bud; synonymous with *vernation.* In Geology, the laminæ or plates into which gneiss, mica-schist, and other crystalline rocks are divided. "*Cleavage,*" says Mr Darwin, "may be applied to those divisional planes which render a rock fissile, although it may appear to the eye quite or nearly homogeneous; *foliation* may be used for those alternating layers or plates of different mineralogical nature, of which gneiss and other metamorphic schists are composed." The subject of foliation has given rise to a great deal of unsatisfactory speculation and hypothesis, some associating the phenomenon with cleavage, contending that the planes of both are generally coincident, and attempting to account for both by the same metamorphic

process; while others maintain that foliation is identical with the lines of bedding, and is a structure conferred on stratified rocks by their original deposition. While leaning to the latter hypothesis, Sir Charles Lyell, at the same time, "fully admits that the alternate layers of quartz, or of mica and quartz, of felspar, or of mica and felspar, or of carbonate of lime, are more distinct in certain metamorphic rocks than the ingredients composing alternate layers in most sedimentary deposits, so that similar particles must be supposed to have exerted a molecular attraction for each other, and to have congregated together in layers more distinct in mineral composition than before they were crystallised."

Foralítes (Lat. *foro*, I bore).—Applied to certain tube-like markings which occur in sandstones and other strata, and which seem to have been the burrows of *annelids*, having the habits of the common lob-worm.

Foraminífera (Lat. *foramen*, an orifice, and *fero*, I bear).—The name given by d'Orbigny to a group of minute, many-chambered shells, or rather many-celled organisms—the calcareous cells of which are pierced, like a sieve, with numerous pores or *foramina*. The foraminifera were supposed by d'Orbigny to be cephalopods, but more recent observation has shown that they are not mollusca, but compound *Protozoa*, whose cellular aggregation produces the many-chambered aspect in question—the numerous pores being for the protrusion of their delicate filaments. They occur in rocks of all formations, from the Silurian upwards—their microscopic remains constituting the greater bulk of the Chalk and Tertiary limestones.—See RHIZOPODA and POLYTHALAMIA.

Forest Marble.—An argillaceous laminated shelly limestone, alternating with clays and calcareous sandstones, and forming one of the upper portions of the Lower Oolite. It derives its name from Whichwood Forest in Oxfordshire, where the finer bands are quarried as a marble.—See OOLITE.

Formation.—"The term '*formation*,'" says Lyell, "expresses in Geology any assemblage of rocks which have some character in common, whether of origin, age, or composition. Thus, we speak of stratified and unstratified, fresh-water and marine, aqueous and volcanic, ancient and modern, metalliferous and non-metalliferous formations." In this wide sense, however, the word is often loosely and inaccurately used; and when speaking of the stratified rocks, it is better to restrict the term to such an assemblage of strata as are connected by mineral composition, by unbroken succession in point of time, and by continuity of fossil species. In this sense we have such assemblages as the "Chalk formation," "Coal formation," &c., whose members, though differing in minor particulars, have evidently been *formed* or deposited under a continuance of similar conditions.

Fossil (Lat. *fossus*, dug up).—Literally anything dug out of the earth; but now restricted by Geologists to "organic remains," or the remains of plants and animals imbedded in the earth's crust, and more or less altered in structure and composition by mechanical and chemical agencies. When these remains are only partially petrified, and occur in superficial or recent deposits, the term *sub-fossil* is employed.

Fossilíferous (Lat. *fossilis*, and *fero*, I bear).—Applied to rocks and rock-systems containing organic remains, in contradistinction to *non-fossiliferous*, or those which contain no such relics.

Fossil-Paper, Fossil-Wool, Fossil-Flax, Fossil-Cork, &c.—Familiar terms

applied to certain varieties of amianthus, according as these appear in thin *papery* flakes, in *flax-like* fibres, in loose *woolly* flocs, or in tough *cork-like* fragments.—See ASBESTOS.

Fossilisátion, Fossilísed, &c.—The conversion of vegetable and animal remains into fossils, by impregnation with mineral or metallic matter.—See PETRIFACTION.

Fracture (Lat. *fractus,* broken).—When a mineral breaks up into determinate forms with smooth regular surfaces, such surfaces are said to constitute its *cleavage;* but when a rock or mineral breaks up irregularly under a blow of the hammer, the appearance of the fresh surface so exposed is termed its *fracture.* Thus the fracture is said to be *even* when it forms a face or plane of some extent; *uneven,* when the surface is rough and unequal; *conchoidal* or shell-like, when concave on one side and convex on the other; *splintery,* when the surface presents the appearance of numerous thin-edged scales; and *hackly,* when covered with numerous sharp points or inequalities.

Fragmentary (Lat. *fragmentum,* a chip or portion broken off, from *frango,* I break).—Applied in Geology to rock-masses composed of the fragments or debris of other rocks; rocks not homogeneous in texture; nearly synonymous with breccias or breccio-conglomerates, which see.

Frangibility.—In Geology, the degree of facility with which a rock yields to the hammer.

Freestone.—Any rock which admits of being freely cut and dressed by the builder; generally applied in Scotland to the varieties of sandstone.

Freshet.—A river-flood or inundation, occasioned by the sudden melting of the ice and snow in spring; the predominance of fresh-water in tidal estuaries, during periodical rain-falls and land-floods.

Friable (Lat. *frio,* I grind or crumble).—Easily broken into small pieces; easily crumbled or reduced to powder. The opposite of tough or tenacious.

Fringing-reefs.—A class of coral-reefs, known also as "shore-reefs," from their fringing or encircling islands at a moderate distance from shore. "They differ from barrier reefs," says Darwin, "in not lying so far from shore, and in not having within a broad channel of deep water." The reefs which fringe the island of Mauritius form a good example of the class.—See CORAL REEFS.

Frith (Lat. *fretum*).—An arm of the sea, as the Frith of Forth, the Frith of Tay, &c. Originally applied to any strait narrow passage, or inlet.

Frond (Lat. *frons,* a branch).—In Botany, the term applied to the foliaceous or leaf-like part of Ferns and other flowerless plants. The frond differs from a true leaf both in structure and function, and combines as it were branch, leaf, and fructification in one organ.—See FERN.

Frost (Sax.)—In Meteorology, the freezing, or conversion into ice, of water and watery vapours by the influence of cold. In ordinary circumstances water passes into ice when the temperature of the air falls to 32° of Fahrenheit; but as the cold increases the frost becomes more intense, and substances (such as oils, mercury, &c.) which remained liquid at 32°, gradually lose their caloric and pass into the solid state. As a Geological agent, frost exerts a purely mechanical influence, but this influence is of prime importance in disintegrating rocks and soils, moulding the contour of mountains, and assisting in the dispersion of boulders and other debris, not only from higher to lower levels, but from the land over the bottom

of the ocean. Thus, the rain and moisture that enter the fissures of cliffs, and between the particles of all rocky matter, are often frozen during winter, and in this state of ice expand and force apart these rocks and particles. When thaw comes, the particles, having lost their cohesion, fall asunder; and thus, under all latitudes and at all altitudes, where frost occurs, vast waste is every winter effected—and this in proportion to the intensity of the cold, which may range from freezing to 60° below freezing, and according to the rapidity and frequency of the alternations from fresh to freezing. It is also by the action of frost that avalanches, glaciers, and icebergs are formed on mountains above the snow-line and in arctic regions: the *avalanche* of snow and ice, which, losing its coherence, is launched from the mountain-side, carrying masses of rock and soil and trees before it—the *glacier*, or ice-lake, that gathers in the mountain-glen above, and slowly grinds its way to the valley below, smoothing the rocks in its passage, and leaving as it melts away its lateral and terminal ridges of gravel and debris, technically termed "moraines"—and the *iceberg* detached by fracture from the projecting glacier of some arctic shore, that floats its burden of rock and gravel to warmer latitudes, there to drop them as it melts away on the bottom of the ocean. In the study of frost-operations, whether among the cliffs and gorges of mountains like the Alps and Himalayas, or along the shores of the Arctic Ocean, the observer discovers at once an important cause of present change and a key to the solution of some of the most interesting of geological problems.—See ICE, ICEBERG, &c.

Fucoides (*fucus*, sea-weed, and *eidos*, likeness).—The generic term for any fossil fucus or fucus-like organism of unknown affinity.

Fucoids (*fucus*, sea-weed, and *eidos*, likeness).—Fucoids, or fucus-like impressions, occur in strata of every epoch, from the lower silurians to the upper tertiaries. Such terms, therefore, as "fucoidal sandstones," "fucoidal shales," &c., are not unfrequent in geological descriptions.

Fúlgurite or **Fúlgorite** (Lat. *fulgur*, lightning).—Any rocky substance that has been fused or vitrified by lightning. More strictly applied to a bore or tube produced by the passage of lightning into a sandy soil, which it sometimes penetrates to a depth of twenty feet, fusing and vitrifying the sand and gravel in its downward progress. *Fulgorites* are occasionally dug up in the sandy plains of Silesia and Eastern Prussia.

Fuller's Earth.—A term applied to certain soft unctuous clays of the oolite and chalk systems, from their being employed in the fulling of woollens. Any clay of sufficiently fine texture, and containing from 20 to 30 per cent of alumina (which is the active grease-absorbent) will serve as a fuller's earth. So important at one time was this earth to the woollen manufacture of England that its exportation was prohibited by act of Parliament. Its place is now mainly supplied by soap and other detergents, though considerable quantities are still dug and prepared for the fuller in Surrey and Bedfordshire. In Geological classification the term is applied to an argillaceous stratum ("the Fuller's Earth") which lies between the Great and Inferior Oolites, near Bath.

Fumaróle (Ital. *fumare*, to smoke).—An opening or orifice, in a volcanic district, from which eruptions of smoke and other gaseous fumes are emitted.

Fúngia, Fúngidæ.—A genus and family of single lamellated corals, so called from the resemblance of their stony structure to that of a fungus or

mushroom. They are of a depressed form, have the under surface scabrous, and are divided above by numerous lamellæ or plates, which radiate from a central oblong depression. The original genus *Fungia* of Goldfuss is now broken up into *micrabacia*, a form peculiar to the chalk and greensand, *anabacia* to the oolite, and *palæocyclus* to the silurian system.

Fungoíd, Fungiform (Lat. *fungus*, a mushroom, and *eidos*, likeness).—Applied to nodular excrescences and petrifactions which resemble the clustering tubercular growth of the fungus; also to single structures (*e.g.* certain corals) which resemble the mushroom in form.

Fusible Metal.—An alloy of eight parts of bismuth, five of lead, and three of tin, which melts at the boiling-point of water (212° F.), and may be fused over a candle in a piece of stiff paper, without burning the paper.

Fúsiform (Lat. *fusus*, a spindle, and *forma*, likeness).—Spindle-shaped; thickest in the middle, and tapering towards the extremities; *e.g.* shells of the genus *Fusus* or "spindle-shell."

Fusion (Lat. *fusus*, melted, from *fundo*, I pour out).—The state of melting. Solid substances, as iron, basalt, &c., when rendered fluid by the application of heat, are said to be in a state of *fusion*. Substances which admit of being melted are termed *fusible;* those which resist the action of fire are termed *refractory*.

Fusulína (Lat., a little spindle).—A genus of foraminiferous organisms, occurring in the Carboniferous formation, and so termed from their fusiform shells, which are elongated transversely—the cells being divided internally by constrictions. Regarded as the earliest and most ancient type of the Foraminifera yet known.

Fusus (Lat., a spindle).—An extensive genus of gasteropods belonging to the *Muricidæ* or *Murex* family, having a world-wide distribution, and occurring also in a fossil state from the oolite upwards. The spindle-shell, red-whelk or *buckie* of our own shores, may be taken as a type. They inhabit sandy or muddy bottoms, and have a range from 5 to 70 fathoms.

G

Gábbro.—An Italian term for a rock consisting essentially of diallage and felspar; the *euphotide* of French geologists.

Gad.—In Mining, a pointed wedge of a peculiar form, much used in Cornwall for underground purposes; hence the title "Pick and Gad" recently adopted for a mining periodical.

Gadolinite.—A greenish-black mineral, occurring massive, and in granular and prismatic concretions, in granitic and felspathic rocks. It is named after Dr Gadolin, who, in 1794, discovered the earth *yttria* in specimens obtained from Ytterby in Sweden. According to Berzelius, it consists of 45.93 yttria, 24.16 silica, 16.90 protoxide of cerium, 11.34 protoxide of iron, with traces of magnesia, lime, and glucina. When heated, Gadolinite becomes incandescent, but undergoes no change in weight—a property which Rose ascribes to the liberation of specific heat, the quantity in the mineral before and after ignition being different.

Gahnite.—Known also as *Automalite;* a native aluminate of zinc, named after its discoverer, Gahn.

Galecýnus (Gr. *galê*, weasel, and *kyon*, dog).—A term applied by Owen to the remains of a viverrine fox, from the fresh-water tertiary deposits of Œningen—the characters of the bones indicating a genus intermediate between the polecats and dogs; that is, *viverra* and *canis.*

Galéna (Gr. *galeo,* I shine).—Native sulphuret of lead; lead-glance. So called from its bluish-grey colour and metallic lustre. Galena is the chief ore of lead in this country, occasionally occurring in crystals, but most frequently massive, and disseminated in granular, compact, or laminar aggregates. It is found in veins in the crystalline rocks, and abundantly in the carboniferous limestone. It usually contains a small proportion of silica, varying from 1.03 to .06 per cent, and very rarely amounting to 1 per cent.

Galeocérdo (Gr.)—Literally "fish-fox;" a genus of sharks whose broad-based, sharp, serrated teeth occur fossil from the Lower Tertiaries upwards.

Galerítes, Galerítidæ (Lat. *galea,* a helmet).—A genus and family of sub-conical, helmit-shaped sea-urchins abounding in the Chalk formation, and from their shape popularly known in Kent and Sussex as "sugar-loaves." In the *Galeritidæ* the shell is high and much inflated, more or less conical above, and oblong-oval at the base, narrowing towards the hinder part. The ambulacra are simple, never petalloid; the poriferous zones extend from the summit to the mouth, which is situated in the centre of the base; the outlet near the posterior margin. One of the most abundant species is the *albo-galerus,* so termed from its fanciful resemblance to the white conical caps of the priests of Jupiter.

Galesáurus (Gr. *galê*, polecat, and *saurus*, lizard).—A provisional genus of Crocodilians, founded on an entire cranium and lower jaw, from the sandstone rocks of Rhenosterberg, South Africa; and so named by Professor Owen from the resemblance of its dentition (which is quite of a mammalian character) to that of the weasels and polecats.

Galionélla (Lat., a small helmet).—An abundant genus of Diatoms or microscopic plant-growths, so called from the cylindrical, globular, or helm-shape of their siliceous shields. They are free, but usually occur in chains; and abound in pools and lakes, as well as in tertiary marls and other microphytal earths.

Gallery.—In Mining, a working drift or level from which the mineral has been excavated.

Gang or **Gángue.**—The German term for a vein or lode; literally, a course or passage.—*Gangue,* the veinstone or matrix in which the metallic ore occurs.

Gánglioneura (Gr. *ganglion,* a knot, and *neuron,* nerve). — Literally "knotted-nerves;" a name applied by Rudolphi to the articulate and molluscous divisions of the animal kingdom, because characterised by a ganglionic type of the nervous system. In the Articulata the ganglia are always disposed symmetrically along the middle line of the body, and brought into communication by a double chord; whence these have been termed *Homogangliata.* In the Mollusca, on the other hand, the ganglia are dispersed and placed at a distance from each other, and from the mesial line, and are frequently unsymmetrical in their arrangement; hence these have been termed *Heterogangliata.*

Gánister or **Gannister.**—The local name of a fine hard-grained grit which occurs under certain coal-beds in Derbyshire, Yorkshire, and the North of England.

Ganoid, Ganoidean (Gr. *ganos,* splendour, and *eidos,* likeness).—The second order of fishes in Agassiz' arrangement. They have angular scales regularly arranged, and composed of horny or bony plates, covered with a strong shining enamel. The *Ganoideans* are chiefly palæozoic and extinct forms : the bony pike of Canada and the sturgeon are living examples.

Garnet (Fr. *grenat,* Ital. *granato,* quasi *granum,* a grain).—In modern systems of Mineralogy the garnets constitute an extensive but extremely variable family, according as lime, alumina, iron, or similar bases, are associated with the silica, which composes about half the mineral. They occur chiefly in mica-schist and other crystalline strata, but are found also in granite, trap, and other igneous rocks. The garnet proper appears in dodecahedral crystals and druses, in grains, occasionally in thin subordinate bands, or so thickly studding portions of the gneiss and mica-schist that millstones have been made from the mass. The colour of the garnet is usually a deep amber-red, reddish-brown, or black, but occasionally olive-green passing into yellow; its lustre is vitreous or resinous; and it is transparent in all degrees. Of the better-known varieties we may mention the *almandine* or noble garnet, of a beautiful columbine-red; the *grossular* or olive-green ; the *Hessonite* or *Cinnamon-stone;* the *Colophonite* or resinous garnet; and the lime, magnesia, and common iron-garnets so abundant in most localities.

Gáseous (Teut. *gas,* air or breath).—In the form of gas; consisting of gas—*gas* being the term applied to all permanently elastic or aëriform fluids, except the atmosphere, which is an admixture of two or more gases. In nature the gases play an important part, and geologically speaking, are of vast significance. Some, like oxygen and carbonic acid, are continually corroding, wasting, and forming new compounds; others, like carbonic acid, sulphuretted hydrogen, and carburetted hydrogen, are largely disengaged from the crust of the earth by volcanic vents, springs, mines, and other openings; some again, as oxygen, carbonic acid, and nitrogen, are indispensable to vegetable and animal life; while others, as oxygen and hydrogen, form permanent combinations, as in the rocks of the crust, the atmosphere that surrounds it, and the waters which cover so large a portion of its surface.

Gasterópoda (Gr. *gaster,* the belly, and *pous, podos,* a foot).—An extensive class of mollusca which, like the periwinkle and garden-snail, have a distinct head, and move by means of a muscular foot attached to the lower part of the body; hence the term "belly-footed." Representatives of the class occur in all formations, from the silurian upwards; but both genera and species increase in ascending order. — See tabulations, "Animal Scheme."

Gastórnis (*gaston,* after M. Gaston Plante, the discoverer, and *ornis,* bird).—A provisional generic term applied to certain bird remains from the eocene tertiaries of Meudon, near Paris. The leg and thigh bones are the only portions yet discovered, and these indicate a bird as large as an ostrich, but more robust, and having affinities to wading and aquatic orders—that is, of an extinct genus intermediate between the *grallatores* and *cursores.*

Gault or **Golt.**—A provincial term, and now adopted in Geology, for that

series of dark-blue marls or calcareous clays which occur between the upper and lower greensands of the Chalk formation, as developed in the south of England. It is sometimes known as *Folkstone Marl;* ranges from 100 to 150, or even occasionally to 200 feet in thickness; and abounds in marine shells—ammonites, hamites, scaphites, belemnites, inocerami, &c., often in a beautiful state of preservation. When decomposed, it forms a strong fertile soil; and, according to Mr Austin, is the main repository of those "phosphatic nodules" now so highly prized by the agriculturist.

Gávial.—The Gavial or Gangetic Crocodile; an existing genus and species of crocodile, characterised by its prolonged, slender snout, which terminates in a cartilaginous protuberance, in which the nostrils are situated—by its numerous teeth of nearly equal size, throughout the whole of the jaws—and by its hind feet, which are palmated to the extremities of the toes. Slender-snouted crocodiles of closely allied forms—*teleosaurus, steneosaurus,* &c.—occur in the lias, oolite, and wealden.

Gaylenreuth.—A village of Franconia in Germany, celebrated for its Bone-Cave, which lies to the north-west of the village, on the left bank of the Wiesent, which has cut its channel through the limestone. According to Cuvier, who examined large collections of the bones, three-fourths of them belonged to bears (*ursus spelæus,* and *priscus*); and the remaining portion to hyenas, tigers, wolves, foxes, gluttons, and other small carnivora.

Gay-lussite (after the French Chemist, Gay Lussac).—A mineral occurring in the natron beds of South America, in long nail-like transparent prisms, and consisting of 34.5 carbonate of soda, 33.6 carbonate of lime, and 30.4 water. It is slowly and partially soluble in water.

Géhlenite.—One of the Scapolite family; a mineral occurring in small greenish or greyish-brown crystals, along with calc-spar, in Mount Monzoni in the Fassa Valley, and so named after Gehlen the chemist. It is a ferro-silicate of alumina and lime, and closely related to *Humboldtilite.*

Gem (Lat. *gemma*).—A general term for any precious stone. In Mineralogy the "Gems," which include the ruby, sapphire, topaz, emerald, &c., are usually erected into a separate *family,* and, as Mr Nicoll observes, "notwithstanding their diverse chemical composition, must ever appear a highly natural one, when regarded as individual objects. Their great hardness, tenacity, high specific gravity without the metallic aspect, their brilliant lustre, transparent purity and vivid colours,—all mark them out as a peculiar distinct family. Only the diamond, which might naturally seem to take the chief place in this class, differs so much, not only in elementary composition, but in physical properties, that it must be assigned to a diverse place in the system." Gems are usually spoken of as *natural* and *artificial;* the latter being composed of vitreous "pastes," coloured by different metallic oxides.

Génus (Lat., kind or kindred).—In Natural History, the word *genus* has often wide, and not well-defined limits, but is generally regarded as embracing such members of a Family or larger group as possess some common properties, more marked in them than in the other members of the family. Thus the **Canidæ** or Dog-family embraces the dog, wolf, jackal, fox, &c.; but the dog, wolf, and jackal are regarded as one genus, *canis,* while the foxes are separated into another genus, *vulpes,* the points of agreement between the dog and wolf being more numerous and intimate than between the dog and fox. The other *permanent* differences between

the individuals of the same genus constitute a *species;* and the *accidental* differences found among the species give rise to *varieties.*

Geodes (Gr. *geodes,* earthy).—Originally applied to nodules of indurated clay or ironstone, hollow within, filled with soft earthy ochre, or having a free nucleus or kernel, which rattled when the nodule was shaken; the *ætites,* or eagle-stone, of the ancients. The term is now generally employed to denote all rounded nodules having internal cavities, whether empty, nucleated, or lined with crystals.

Geógnosy (Gr. *gè,* the earth, and *gnosis,* knowledge).—A term invented to express absolute knowledge of the earth, in contradistinction to *Geology,* which embraces both the facts and our reasonings respecting them. The term, however, is seldom used by British Geologists.

Geógony (Gr. *gè,* the earth, and *gonos,* generation).—Like cosmogony, geogony consists in abstract speculations regarding the original formation of the earth, and is altogether distinct from the definite and intelligible science of Geology.

Geólogy (Gr. *gè,* the earth, and *logos,* doctrine).—Embraces all that can be known of the constitution and history of our planet. Its object is to examine the various rock-materials of which our planet is composed, to describe their appearance and relative positions, to investigate their nature and mode of formation, and generally to discover the laws which seem to regulate their arrangement. As thus defined, the science may be viewed in three great aspects—Descriptive, Theoretical, and Practical; *Descriptive Geology* being that which restricts itself to a consideration of facts and appearances as presented in the rocky crust; *Theoretical,* that which attempts to account for the phenomena, and arrange them into a connected world-history; and *Practical,* that which, guided in its researches by the other two, treats of the mineral products of the globe, the methods of obtaining them, and their application to industrial or economic purposes.

Geosáurus (Gr. *gè,* the earth, and *saurus,* a lizard).—A gigantic terrestrial reptile of the Oolitic epoch.

Geoteúthis (Gr. *gè,* the earth, that is, fossil, and *teuthis,* a squid).—A genus of fossil squids or calamaries, whose short broad *pens,* pointed behind, and truncated in front, with lateral wings shorter than the shaft, occur abundantly and in many species in the clays of the Lias and Oolite. Besides the *pens* of this calamary, the *ink-bag,* the muscular mantle, and the bases of the arms, are preserved in the Oxford clay. Some of the ink-bags found in the Lias are nearly a foot in length, and are invested with a brilliant nacreous layer; the ink, like that of the recent analogues, forming excellent *sepia.* It is difficult to understand how these ink-bags were preserved, as the existing calamaries "spill their ink" on the slightest alarm; unless we suppose, with Dr Buckland, that their possessors were instantaneously enveloped in the muddy deposit that now entombs them.

Gervíllia (dedicated to M. Gerville, a French naturalist).—A genus of the Aviculidæ, or wing-shells, found fossil in many species, from the Carboniferous system to the Chalk inclusive. Shell like *avicula;* elongated, anterior ear small, posterior ear wing-like; area long and flat, cartilage pits several wide apart; hinge-teeth obscure, diverging posteriorly.

Géyser.—An Icelandic term for the intermittent boiling-springs, or spouting fountains, which occur in connection with the volcanic phenomena of that island. "These intermittent hot springs occur in a district situated in the south-western division of Iceland, where nearly one hun-

dred of them are said to break out within a circle of two miles. They rise through a thick covering of lava, which may perhaps have flowed from Mount Hecla, the summit of that volcano being seen from the spot, at the distance of more than thirty miles. In this district the rushing of water is sometimes heard in chasms beneath the surface; for here, as on Etna, rivers flow in subterranean channels through the porous and cavernous lavas. It has more than once happened, after earthquakes, that some of the boiling fountains have increased or diminished in violence and volume, or entirely ceased, or that new ones have made their appearance —changes which may be explained by the opening of new rents, and the closing of pre-existing fissures. Few of the geysers play longer than five or six minutes at a time, and the intervals between their eruptions are for the most part very irregular. The Great Geyser rises out of a spacious basin at the summit of a circular mound, composed of siliceous incrustations, deposited from the spray of its waters. The diameter of this basin in one direction is fifty-six feet, and forty-six in another. In the centre is a pipe seventy-eight feet in perpendicular depth, and from eight to ten feet in diameter, but gradually widening as it rises into the basin. The inside of the basin is whitish, consisting of a siliceous crust, and perfectly smooth, as are likewise two small channels on the sides of the mound, down which the water escapes, when the bowl is filled to the margin. The circular basin is sometimes empty, but it is usually filled with beautifully transparent water in a state of ebullition. During the rise of the boiling water in the pipe, especially when the ebullition is most violent, and when the water is thrown up in jets, subterranean noises are heard, like the distant firing of cannon, and the earth is slightly shaken. The sound then increases, and the motion becomes more violent, till at length a column of water is thrown up, with loud explosions, to the height of one or two hundred feet. After playing for a time like an artificial fountain, and giving off great clouds or vapour, the pipe or tube is emptied, and a column of steam rushing up with amazing force, and a thundering noise, terminates the eruption. If stones are thrown into the crater, they are instantly ejected; and such is the explosive force, that very hard rocks are sometimes shivered by it into small pieces. Henderson found that, by throwing a great quantity of large stones into the pipe of Strockr, one of the geysers, he could bring on an eruption in a few minutes. The fragments of stone, as well as the boiling water, were thrown in that case to a much greater height than usual. After the water had been ejected, a column of steam continued to rush up with a deafening roar for nearly an hour; but the geyser, as if exhausted by this effort, did not send out a fresh eruption when its usual interval of rest had elapsed."—(*Lyell's Principles*, as condensed from Barrow, Henderson, Mackenzie, and others who have visited Iceland.) Various theories have been proposed to account for the phenomena of the geysers, but that proposed by Sir G. Mackenzie, and which connects the intermittent eruptions of steam and water with the formation and expansion of steam in caverns and fissures in the lava beneath, is that which is generally accepted. It is obvious, if fissures and caverns exist, that steam of a very high pressure must be found in them by the passage of the boiling waters along the subterranean channels; and as the pressure increases, the steam will force itself forward, and escape by the nearest opening. Once discharged, it will require some time before another supply can be formed of the requisite pressure and temperature.

According to Mr Roberts, all the waters issuing from these springs are highly charged with silica; hence siliceous incrustations and deposits cover the adjacent country to the extent of four leagues, and the streams proceeding from the springs often resemble milk in appearance, owing to the argillaceous bole they take up in their passage among the siliceous concretions (palagonite tufa) and accumulations.

Ghauts.—A term applied originally to the narrow and difficult passes in the mountains of Central Hindostan, but has been gradually extended to the mountains themselves—viz, the Eastern and Western Ghauts, which consist of two great chains, stretching along the east and west coasts of the Deccan.

Gíbbous (Lat. *gibbus*, bunched, humped).—Applied to forms that have a suddenly convex, or hump-like external surface. Bossed; abruptly protuberant, like the upper surface of the *cypræa gibbosa* or hump-backed cowry.

Giraffe.—The tallest of known quadrupeds, and now restricted to the deserts of Africa, was once a native of Europe and Asia, for fossil bones of a species of this remarkable ruminant have been found in the upper tertiaries of Issoudun in France, and in the Siwalik Hills in Hindostan, associated with varieties of the Elk, Deer, &c.

Girasol (Lat. *gyro*, I turn, and *sol*, the sun).—Known also as *fire-opal;* a transparent variety of opal, having a brilliant vitreous lustre, and of a bright hyacinth red, particularly when turned towards the sun, or any bright light: hence the name. The finest specimens are strongly translucent and show a faint bluish light, coming as it were from the interior of the stone.

Glácier (Lat. *glacies*, ice).—Applied to those accumulations of ice, or of snow and ice, which collect in the valleys and ravines of snowy mountains like the Alps, and which move downward with a peculiar creeping motion, smoothing the rocks over which they pass, and leaving mounds of debris (*moraines*), lateral and terminal, as they melt away. According to Saussure, glaciers are of two kinds—those formed in valleys and following the windings of their courses (the *ice-river*), and those formed in the slopes and higher peaks of the mountains in sheet-like masses. In both, the mode of action is almost identical; and combined with the *avalanche* and *iceberg*, the glacier is now, as it has been in ages past, one of the most important of geological agents. The evidence of glaciers in any country, during former epochs, consists partly in the polished and grooved surfaces of the rocks over which they slid with their impacted boulders and shingle (these scratching and grooving in the direction of that movement); and partly by the peculiar contour and composition of the moraines, which differ materially from beds of debris brought down by torrents and other currents of water. As glaciers can only be formed above the line of perpetual congelation, and melt when they descend to that level, important inferences as to climate can often be drawn from the occurrence of moraines, rock-groovings, and other kindred phenomena.

Glacís (Fr.)—A slope in fortification; applied to easy insensible slopes like those of a harbour-breakwater, or the shingle piled on the shore by the force of the waves; less steep than a *talus*.

Glance (literally, *splendour*). — A frequent term of the earlier mineralogists, and applied to such minerals as exhibited a glancing or pseudo-metallic lustre, as lead-glance, iron-glance, glance-coal, &c. The term is now seldom employed.

Glance-Coal.—A familiar term for anthracite (which see), in allusion to its semi-metallic lustre.

Glass.—The well-known silicates of potash and soda (quartz-sand fused with one or other of these alkalis); but which are variously compounded to give them colour, transparency, toughness, &c. Thus *green* or *bottle glass* consists of the silicates of alumina, of the oxides of iron, magnesia, and potash, or soda; *flint-glass,* a silicate of potash and lead; *window-glass,* a silicate of soda and lime; and *plate-glass,* silicate of potash and lime. In Mineralogy, the term *glass* is applied to several substances having a glassy appearance, as *Muscovy-glass* or mica, *tin-glass* or bismuth, *glass of antimony* or sulphuret of antimony.

Glaúberite.—A rare crystallised salt, occurring in oblique four-sided prisms, and consisting of 51 parts sulphate of soda and 49 sulphate of lime. It is found associated with rock-salt in Spain, South America, and other localities.

Glauber-Salt (after Glauber).—Native sulphate of soda; the *sal-mirabile* of the older chemists. It occurs chiefly as an efflorescence in quarries and on old walls, as in the salt-mines of Austria, Spain, and other countries; it is deposited in great abundance from the hot springs at Carlsbad, and is found in many other mineral waters; and is likewise procured from salt springs, and forms a crust or efflorescence on the borders of salt lakes in Egypt, Southern Russia, and other countries.

Glaúcolite (Gr. *glaucus,* bluish-green, sea-green, and *lithos*).—A pale-blue or greenish variety of Labrador felspar, from Lake Baikal in Siberia.

Glaucónie or Glauconie Crayeuse.—The French term for certain strata (bluish chalky marls and greensands) which appear to be on the same horizon, and in part the equivalents of our Upper Greensand and Gault.

Glaúconite (Gr. *glaucus,* bluish-green).—A mineral forming small round grains in the greensand of England, France, Germany, and North America, and very similar in colour, &c. to *green-earth,* but seems essentially a hydrous silicate of iron *protoxide* and potash. In green-earth, the iron is the state of *peroxide.*

Glimmer.—The term applied by Werner to the several varieties of mica; occasionally used to designate talcose and micaceous compounds.

Globígerína (Lat. *globus,* a sphere, and *gero,* I carry).—A genus of foraminiferous organisms, whose many-celled shell is turbinated, cells spheroidal, and the last, or terminal one, furnished with a semicircular aperture at the umbilical angle. Several fossil species abound in the Chalk and in Tertiary deposits; and many species still swarm in our seas.

Glóbular (Lat. *globus,* a ball).—Round; applied to forms more or less spherical. *Globule,* any minute rounded particle.

Glossopétra (Gr. *glossa,* the tongue, and *petra,* stone).—Literally "tongue-stone;" an early term for the flattened tongue-shaped shark's teeth, so abundant in many of the upper secondary and earlier tertiary formations. Known also as *Lamiodontes* or throat-teeth, and *odontopetræ* or teeth-stones.

Glossópteris (Gr. *glossē* tongue, and *pteris,* fern).—A genus of Oolitic ferns, so called from their tongue-shaped leaves (which were four-parted), and now known as *Sagenopteris,* which see.

Glucína (Gr. *glucus,* sweet).—A rare earth, discovered by Vauquelin in 1798, and constituting nearly 14 per cent of the emerald and beryl, which owe to it their fine green colour. It combines with all the acids, and

forms, with them, sweetish salts: hence its name. According to Sir H. Davy, it is an oxide of *glucinum*—a metallic basis not yet obtained in a separate state.

Glyphæa (Gr. *glyphê,* sculpture).—A genus of small lobster-like crustaceans (*Astacidæ*), whose carapaces occur in the Oolite of England; and so termed from the sculptured ornamentation of their outer surfaces.

Glyptocrínus (Gr. *glyptos,* sculptured).—A genus of Lower Silurian encrinites, characterised by their highly-ornamented basal plates; whence the name.

Glýptodon (Gr. *glyptos,* sculptured, and *odous,* tooth).—So named from the deeply-grooved teeth; a gigantic edentate animal from the upper Tertiaries of South America; allied to the armadilloes (*Dasypinæ*), and furnished with a carapace or coat of mail, formed of polygonal bony plates, united by sutures, which constituted an impenetrable covering for the upper part of the body. The plates of this bony integument were not disposed in rings as in the armadillo, but were articulated to each other, and formed a tessellated cuirass; the tail was enclosed in a case of this kind, like a sword in its scabbard.—See DASYPUS.

Gneiss.—Originally a German term for a peculiar granitic-looking rock occurring at the very base of the so-called "Primary strata;" but now applied not only to the *rock* properly so called, but to the *whole suite* of hard, crystalline granitoid schists which constitute the lowest portion of the metamorphic or non-fossiliferous strata. As a rock, it occurs in three main varieties—viz. *Gneiss Proper*—an aggregate of quartz, felspar, and mica, occasionally garnetiferous; *Porphyritic Gneiss* — the same as preceding, with large irregular macles of felspar or quartz; and *Syenitic Gneiss*—of quartz, felspar, and hornblende. As a *suite*, or portion of the metamorphic system, it consists of irregularly interstratified schists—gneiss, mica-shist, quartz-rock, crystalline limestones, &c.—all of which have been subjected to less or greater intensity of metamorphic action, though originally deposited as muds, clays, and sands. In whatever state of aggregation the particles of *Gneiss* may have been when originally deposited, we know that it is now a hard, tough, crystalline rock, exhibiting curved and flexured lines of stratification, and composed in the main of quartz, felspar, mica, and hornblende. Mineralogically speaking, it differs from the granitic rocks with which it is associated chiefly in this, that while the crystals of quartz, felspar, &c., are distinct and entire in granite, in gneiss they are broken, indistinct, and confusedly aggregated. There is also this essential distinction, even where the mineral aspects of the two rocks are most alike, that the gneiss never sends out dykes and veins, like the granite, into contiguous strata; nor does it ever assume the tabular or sub-columnar structure so frequent in granite—a structure peculiar to rocks which are the products of cooling and consolidation from a state of igneous fusion. In the most granitoid masses of gneiss, the stratified disposition is never wholly obliterated; hence their *fissility* in one direction as compared with the indeterminate and hackly *fracture* of the true igneous granites. Though GNEISS is thus (generally speaking) the oldest or lowest of the Primary strata, it may occur in any system, just as the strata of that system may have been subjected to the necessary metamorphic agency of heat and other mineralising conditions; and so it happens that many of the secondary strata of the Alps are as highly crystalline as the primary schists of the Grampians.

Gneissic, Gneissose.—Having the aspect of gneiss; partaking of the qualities of gneiss; exhibiting the crystalline texture and foliated and flexured structure of gneiss.

Gold (Ger.)—The most valuable and longest known of the metals. It occurs native in capillary, thread-like, aborescent, and moss-like aggregates; in plates and laminæ; and in masses known as *pepitas* and *nuggets.* Very frequently it is found disseminated in minute microscopic particles throughout the quartz or vein-stone in which it occurs. Geologically, it is distributed in veins, nests, and lodes in the primary and palæozoic schists, but is most frequently found in the sands, gravels, and debris which have arisen from the waste and disintegration of these schists during the later Tertiary and Post-tertiary periods. Thus, though worked in the vein-mines of Mexico, South America, the Rocky Mountains, and Australia, the main commercial supply is obtained from the auriferous sands and gravels of the Ural, Hungary, Africa, California, Brazil, Australia, and other gold-yielding districts — the drift-workings being inexhaustible, though capriciously fertile, while the veins and lodes are said to become poorer the deeper they are followed. Gold is one of the most widely-disseminated metals, being found in every known region; but rarely in such local abundance as to pay for its search, collection, and preparation. It is also frequently found in combination with other metals, as palladium, rhodium, and silver, but generally so disseminated as to require skilful and expensive methods of extraction and purification.

As a metal, it is characterised by its yellow colour; its extreme permanence in air and fire—being little tarnished by any amount of exposure, and melting at 2016° Fahr.; its usual hardness is about 2.6; its density or specific gravity from 18 to 19.4; its malleability is such that it may be beaten into leaves not more than $\frac{1}{280000}$ of an inch in thickness; and its ductility so great that one grain is capable of being drawn out into 500 feet of wire. It readily forms alloys with other metals; and in coinage as well as in the arts it is generally so alloyed (with copper, silver, &c.) to improve its hardness, and so render it better able to resist the tear-and-wear of circulation, handling, and cleaning. Gold is not acted upon by the common acids; but chlorine and nitro-muriatic acid corrode and dissolve it, forming a chloride of gold, which is soluble in water.

Gómpholite (Gr. *gomphos,* nail, and *lithos*).—A term applied by Brongniart to certain sandy conglomerates of the middle tertiary epoch which occur in vast thickness at the foot of the Alps in the great Swiss valley, where they are known as *Nagelflue,* which see.

Goniáster (Gr. *gonia,* an angle, and *aster,* star).—A genus of fossil star-fishes occurring in the Greensand, Chalk, and older Tertiaries, and popularly known as *Cushion Stars.* They are characterised by their solid pent-angular bodies, which in some species are obtuse at the angles, and in others more or less pointed and arm-like. The ossicles of the disc are generally punctated, and the margins are provided with a double series of larger plates bearing granules or short spines.

Goniatítes (Gr. *gonia,* an angle).—A genus of the Ammonite family, so called from the angular or zigzag lines which mark the junctions or sutures of its chambers. In the goniatite which ranges from the Devonian to the Trias, and of which there are about 150 species, the shell is discoidal, sutures lobed, lobes simply angulated, siphuncle dorsal.

Goniómeter (Gr. *gonia,* a corner, and *metron,* a measure).—An instru-

ment for measuring angles, particularly those of crystals. Two instruments have been specially used for this purpose—the common or *contact goniometer* invented by Carangeau, and the *reflecting goniometer* of Dr Wollaston.

Goniópholis (Gr. *gonia,* corner or angle, and *pholis,* scale or scute).—Literally "Angle-scute;" a genus of Crocodilians whose teeth, bones, and dermal scutes occur in the Purbeck and Wealden strata. So termed from the angular shape of its scutes, many of which are furnished with a lateral projection, which fits into a corresponding depression of the adjoining scute, thus connecting and giving great strength to the dermal cuirass. Popularly known as the "Swanage Crocodile," from the fine specimen now in the British Museum, having been discovered in the Purbeck beds of that locality in 1835.

Gorgónia, Gorgoníidæ (*Gorgones,* fabled personages whose heads bristled with serpents instead of hairs).—A genus of Anthozoan corals, so called from their branching flexible axes; and popularly known as "Venus's fans" and Sea-fans," from their spreading fan-like forms. The Gorgoniæ are attached by a root; have a shrub-like growth; consist of a horny, flexible axis or central portion, which is covered by a calcareous cell-crust, like the bark of a tree, and often appear in elegant fan-shaped or flabellated forms. A few fossil species have been discovered in the upper chalk of Maestricht and in Tertiary strata.

Góssan (in Cornish mining).—"A peculiar ferruginous condition," says Ansted, "of the top of a lode near its outcrop, considered to be very strongly indicative of the lode below. Some *gossans* are simply ferruginous quartz, but others are solid iron ore. Gossans are seldom found so deep as 30 fathoms. They not unfrequently have a strong decomposed or ochreous appearance, and sometimes contain gold."

Grallatóres (Lat. "walkers on stilts"). The Waders or Stilt-birds; a well-known order of aquatic birds frequenting marshes and shallow waters, and so named from their being raised on their long legs as on stilts. The order comprises the rails, snipes, coots, herons, stilts, cranes, &c.; and is represented in the Tertiary strata by remains having affinity to the curlew, rail, heron, and other grallatorial congeners.

Grammýsia (Gr. *grammè,* a line of writing, and *mys,* a mussel-shell).—A mussel-like bivalve occurring in Upper Silurian strata, and so named by de Verneuil from the strong transverse lines or furrows which cross its valves from the umbones to the middle of the ventral margin. Regarded as a sub-generic form of the fossil genus *Myacites.*

Granite (Lat. *granum,* a grain).—This well-known rock is so termed from its granular-crystalline composition and aspect. The typical granite is a compound of quartz, felspar, and mica, arranged in distinct grains or crystals; and all rocks partaking of the character and appearance of granite are termed *granitic.* The epithets *granitoid* and *granitiform* are, on the other hand, applied to rocks having some resemblance to granite, though not decidedly of granitic nature, nor even, it may be, of true igneous origin. The granitic rocks, properly so called, are all highly crystalline; none of their crystals are rounded or water-worn; they present no traces of deposition or stratification; they occur in the crust as mountain masses and veins, bursting through and displacing the sedimentary rocks; and they indurate and otherwise alter (as all heated masses do) the strata with which they come in contact. From these circumstances they

are held to be of igneous origin; and as far as geologists have been able to discover, they are the most deeply-seated of all rocks—forming, as it were, the floor or foundation for all the superincumbent formations. As the earliest of igneous rocks, they are generally found associated with primary and transition strata, tilting them up on their edges, bursting through them in dykes and veins, and variously altering their positions and mineral character. Though occurring most abundantly among primitive strata, granitic outbursts may be found among rocks of all ages, but certainly not as a marked and general feature of the period—the great epoch of granitic intensity being that which terminated with the deposition of the silurian strata.

Whether occurring in veins or mountain-masses, the structure of granite is irregular and amorphous. In its texture it varies from a close-grained compact rock to a coarse and loose aggregation of primary crystals. In the composition of granitic rocks there is also considerable variety. Thus, ordinary *granite* is composed of crystals of felspar, quartz, and mica; when the dark glassy mineral called hornblende takes the place of the mica, the rock is known by the name of *syenite* (from Syene in Upper Egypt); and when both mica and hornblende are present, the compound is known as a *syenitic granite.* Occasionally talc supplants the mica, and then the admixture of felspar, quartz, and talc is known by the name of *protogine* (literally, first-formed)—a term by no means happily chosen, as many of these talcose granites (like those of the Alps) occur in connection with rocks of secondary formation. The term *hypersthenic granite* is applied to an admixture of quartz and hypersthene, with scattered flakes of mica; and *graphic granite* is a binary compound of felspar and quartz—the quartz being disposed through the felspar matrix like the lines of Arabic writing —hence the name. Another fine-grained compound of felspar and quartz, with minute scales of mica, is known by the name of *pegmatite* (*pegma,* compacted); and *porphyritic granite* is the term employed when, in addition to the crystals composing the general mass of the rock, there are indiscriminately mingled through it larger and independent crystals of felspar.

Besides the preceding there are other granitic compounds, in all of which felspar, quartz, mica, hornblende, and hypersthene are the principal ingredients, and talc, steatite, chlorite, schorl, and actynolite the accidental or modifying minerals. It is customary, on this account, to speak of granites as *binary*, *ternary*, and *quaternary*, according to the number of simple minerals that enter into their composition. Thus graphic granite, as composed of felspar and quartz, is a binary; ordinary granite of felspar, quartz, and mica, is a ternary; and syenitic granite of felspar, quartz, hornblende, and mica, is a quaternary compound.—(See GRANITELLE, &c.) There are, however, many blendings of these, one into the other; and in the same hill, or even in the same quarry, we may find some half-dozen varieties of granite, if distinctions are to be founded upon the greater or less abundance of any one constituent mineral. However complicated the mineral admixtures of granitic rocks, and however varied their aspects, there are several features which they preserve in common, and which serve to distinguish them from the later igneous rocks. For instance, they are more crystalline, or rather granular-crystalline, than any other variety of igneous rock; they are never vesicular, cellular, or porous, like trap and volcanic lavas; they exhibit less structure than trap-

pean rocks, being generally massive or cuboidal, and void of that columnar structure so common in basalts and greenstones; they are never amygdaloidal like traps, conglomerated or brecciated like trap-tuffs, or scoriaceous like volcanic tufa. They seem to have been formed at greater depths or under greater pressure than either traps or lavas; hence they are spoken of as *plutonic* in contradistinction to *volcanic*, which may be originated under the open air.

Industrially, granitic rocks are of prime importance—the hard and close-grained yielding the most durable building-stone for heavy structures; the soft and decomposable the finest *kaolin*, or china-clay; the veins and vein-stones such accidental minerals as felspar, apatite, mica, meerschaum, asbestos, rock-crystal, tourmaline, beryl, and other precious stones.

Granitélle.—A term employed by Kirwan to designate a binary granite, or granular aggregate of two ingredients. Thus a compound of quartz and felspar is a *granitelle;* of quartz, felspar, and mica, an ordinary or normal *granite;* of any other three ingredients than those constituting granite, as felspar, quartz, and schorl, or quartz, mica, and schorl, a *granitine;* and a compound of more than three ingredients, a *granilite.* The terms are rarely used by modern geologists.

Granític.—Composed of granite; having some of the characteristics of granite; belonging to the granitic series, which comprehends such rocks as granite proper, graphic granite, syenite, protogine, pegmatite, eurite, and many analogous porphyritic compounds.

Granitoid (Gr. *eidos*, likeness).—Applied to such rocks as have the granular-crystalline aspect of granite. Thus we speak of the "granitoid schists," meaning thereby such rocks as gneiss, hornblende-schist, porphyritic gneiss, and the like, which have much the aspect of granite without being so in reality.

Granulátion (Lat. *granum*, a grain.)—The reduction of metals into grains, drops, or coarse powder—generally accomplished by pouring them in the *melted state* into water.

Graphic Granite (Gr. *grapho*, I write).—Literally "written granite;" a binary compound of felspar and quartz—the quartz being disposed through the felspar matrix like lines of Arabic writing: hence the name.

Gráphite (Gr. *grapho*, I write, and *lithos*, stone).—Literally "writing-stone;" and so called from its use in making writing-pencils. Known also as plumbago and black-lead from its appearance, though lead does not at all enter into its composition. It consists almost entirely of pure carbon, with a small proportion of iron as an admixture, but not in chemical union—the amount being from 5 to 9 per cent. It occurs chiefly in primary formations, but occasionally in later strata in the neighbourhood of igneous irruptions. When crystallised it appears in tabular and short prismatic crystals, but generally it is compact and massive, foliated or scaly, and disseminated or occurring in vein-like nests and patches. It is found in many localities—the purest in Britain being that of Borrowdale in Cumberland, where it is included in a bed of trap subordinate to the clay-slate of the district. It is largely used for making writing-pencils, in the fabrication of fire-proof crucibles, as a polishing material, &c.; and has been artificially produced by placing an excess of charcoal in contact with fused cast-iron.—See COAL FAMILY.

Gráptolites (Gr. *grapho*, I write, and *lithos*, stone). — Characteristic

Silurian zoophytes, akin to the virgularia or sea-pen of modern seas: hence the name. They consist of sessile polype cells, arranged in one or two rows on a flexible stem, and have been subdivided into three groups—1. *Graptolites* proper, or those having a single row of cells united together at the base; 2. *Rastrites,* those having the cells placed—not united—but placed at wide intervals along the axis; and 3. *Diplograpsus,* or those having two rows of united cells arranged along the axis, and presenting a foliaceous appearance. The two first groups seem related to the *Sertularidæ,* the last to the *Pennatula* and *Virgularia* of the present day. There are also others having twin branches, to which the name *Didymograpsus* is applied; and the whole group of these little serrated fossils is usually distinguished by zoologists as the GRAPTOLITHINA.

Graptopóra (Gr. *grapho,* I write, and *pora*).—A rare form of zoophyte occurring in Lower Silurian rocks, and interesting as showing a probable connection between the Fenestellidæ and Graptolites. It is of horny texture, and appears in leaf-like bundles of fine lines radiating from numerous central pores: thence the name.—See PHYLLOGRAPSUS.

Gravel.—The familiar as well as technical term for accumulations of water-worn rock-fragments, where the pebbles vary from the size of a pea to that of a hen's egg. It is generally composed of the fragments of the harder and more siliceous rocks—those longest resisting the process of attrition. Accumulations of finer detritus, whose particles are less than a pea, are known as *sands;* those whose fragments are larger than a hen's egg are generally termed *shingle.*

Grávity, Gravitátion (Lat. *gravis,* heavy).—The mutual tendency which all bodies in nature have to approach each other, with forces which are directly as their masses and inversely proportional to the squares of their distances. As a force it is altogether independent of the nature of the substances on which it acts, and influences alike the particles of a fragment of rock, and the spheres which constitute the systems of the universe. This mutual tendency of all the particles of matter to each other is called the *attraction of gravitation;* in reference to any particular body, the aggregate attraction of all its particles is usually called simply its *gravity* or *weight.* It is owing to this force that all heavy bodies, when unsupported, fall towards the earth, and that in a direction perpendicular to the level surface of water; or in other words, in the direction of the plumb-line, which always points towards the centre of the earth—the attraction of a sphere (as demonstrated by Newton) acting in the same manner as if all its matter were condensed into a single point at its centre. The phenomena of gravity, as manifested on and within the earth, is usually spoken of as *terrestrial gravitation;* that which has reference to the mutual action and reaction of the planetary bodies is denominated *universal gravitation.* Thus the oscillations of the pendulum, and the perpetual tendency of water to fall or seek towards a lower level, depend on terrestrial gravitation; the bi-diurnal rise and fall of the tides, and the regular revolutions of the planets, are sustained by the force of universal gravitation. Owing to the oblate or spheroidal figure of the earth, which makes the distance between the earth's surface and the centre less by some 13 miles at the poles than at the equator, the gravity or weight of body slightly increases as we approach either pole. Thus, according to Newton, a body weighing 194 lb. at the equator, would weigh, if transferred to the pole, 195—and proportionally at all intermediate distances; so that the attraction of

gravity becomes not only a measure of weight, but a means of determining the earth's figure, by ascertaining the intensity of gravitation at different latitudes.

Gravity, Specific.—The Specific Gravity of a body is the ratio of its weight to the weight of an equal volume of some other body assumed as a conventional standard. In Britain, the standard usually adopted for *solids* and *liquids* is distilled water at the temperature of 60° Fahr., and for *gases* or *aëriform bodies,* the ordinary air of the atmosphere. In either case the standard is regarded as unity, or equal to 1. The following list exhibits the specific gravities of some of the more important and abundant rocks, minerals, and metals:—

Agate 2.590	Jet 1.300
Alum 1.714	Ironstone .... 3.000 to 3.575
Amber .... 1.064 to 1.100	Limestone .... 2.386 — 3.000
Amethyst, Common 2.750	Magnesia, Carbonate 2.240
,, Oriental 3.391	Malachite .... 3.572 to 3.994
Amianthus .... 0.315 to 1.000	Marble .... 2.500 — 2.700
Arragonite 2.900	Melanite .... 3.600 — 3.800
Asphalt .... 0.905 to 1.220	METALS—
Azure-stone 2.850	Antimony 6.702
Barytes, Sulphate of 4.550	Arsenic 5.765
,, Carbonate of 4.600	Bismuth 9.880
Basalt .... 2.421 to 3.000	Brass .... 7.809 to 8.400
Beryl 3.549	Cadmium 8.600
Borax 1.714	Chromium 5.900
Calcedony .... 2.600 to 2.650	Cobalt 8.600
Carnelian 2.615	Columbium 5.600
Chalk .... 2.000 — 2.255	Copper 8.900
Chrysolite 3.400	Gold, cast 19.258
Coals .... 1.025 to 1.350	,, hammered 19.361
Coral .... 2.500 — 2.800	Iridium, ,, ... 23.000
Corundum 3.710	Iron, cast 7.248
Diamond, Oriental 3.521	,, forged 7.788
,, Coloured 3.550	Lead 11.352
,, Brazilian 3.444	Manganese 8.000
Dolomite .... 2.540 to 2.830	Mercury 13.598
Emerald .... 2.600 — 2.770	Molybdenum 8.600
Felspar .... 2.450 — 2.700	Nickel, cast 8.279
Galena .... 6.565 — 7.786	,, forged 8.666
Glass, crown 2.520	Osmium-iridium 19.500
,, green 2.642	Palladium 11.800
,, flint .... 2.760 to 3.000	Platina, forged 20.336
Graphite .... 1.987 — 2.400	,, wire 21.042
Gypsum, Compact 1.870 — 2.288	,, plate 22.069
,, Crystallised 2.311 — 2.900	Potassium 0.865
Heliotrope .... 2.629 — 3.000	Rhodium 11.000
Honeystone, Mellite 1.650	Selenium 4.300
Hornblende .... 3.250 to 3.830	Silver 10.474
Hornstone .... 2.555 — 2.810	,, hammered 10.510
Hyacinth .... 4.000 — 4.780	Sodium 0.972
Jasper .... 2.358 — 2.820	Steel, soft 7.833

METALS, *continued*—	Sandstone, Craigleith 2.250
Steel, tempered..................7.820	,, Fife.....................2.100
Tellurium ....5.700 to 6.110	,, Glasgow...............2.156
Tin 7.295	,, Derbyshire............2.628
Tungstein........................17.400	,, Newcastle 2.229
Uranium 9.000	Sapphire, Oriental 4.200
Zinc ....6.200 to 7.200	Schorl ....2.922 to 3.450
Mica.......................2.650 — 2.934	Serpentine ....2.264 — 3.000
Mineral Tallow 0.780	Slate ....2.000 — 2.200
Naphtha ....0.700 to 0.840	Spar, Fluor...............3.090 — 3.790
Nitre 1.900	,, Calc ....2.510 — 2.830
Obsidian 2.370	Sulphur, native.....................2.033
Oolite ....2.100 to 2.600	,, fused 1.990
Opal........................1.958 — 2.110	Talc ....2.000 to 3.000
Pearlstone 2.340	Topaz ....4.000 — 4.066
Pitchstone ....2.000 to 2.700	Tourmaline...............3.000 — 3.680
Porphyry ....2.450 — 2.950	Tourquoise ....2.500 — 3.000
Pumice ....0.752 — 0.914	Ultramarine 2.360
Quartz.....................2.624 — 3.750	Woodstone ....2.000 — 2.675
Rock-Crystal ....2.580 — 2.888	Zeolite ....2.075 — 2.718
Ruby, Oriental 4.285	Zircon ....4.385 — 4.700

GASES.

Atmospheric Air 1.000	Hydrogen, Sub-carburetted ...0.555
Carbonic Acid 1.527	,, Sulphuretted 1.180
Chlorine 2.500	Nitrogen..............................1.041
Hydrogen 0.069	Oxygen 1.111
,, Carburetted............0.972	

Great Oolite. — The "Grand Oolithe" of the French; a frequent synonym of the Bath Oolite, from the great development of its Oolitic limestones and freestones as compared with other members of the system. It belongs to the lower section of the system—having the Stonesfield slate for its base, and being overlaid by the Forest Marble and Cornbrash.

Green-Earth.—An earthy variety of *chlorite*, occurring in various shades of green, having a greasy feel, and faint lustre when rubbed with the nail. It is common in the trap-rocks, occasionally massive, but more frequently filling amygdaloidal cavities, coating agate nodules, or colouring the sides of fissures, &c. with a thin streaky glaze. The finer varieties furnish the *mountain-green* of the colourman and artist.—See GLAUCONITE.

Gréenockite.—Sulphuret of cadmium; one of the blendes, consisting of 77.3 cadmium, and 22.4 sulphur. It occurs in porphyritic amygdaloid, near Bishoptown in Renfrewshire, and is named after its discoverer Lord Greenock.

Greensand.—The lower portion of the Cretaceous or Chalk system as developed in the south of England, and so named from its greenish colour, which it owes to a chloritous silicate of iron. These sands, however, are not uniformly green, but partake of ochraceous and yellow tints; present various degrees of fineness, from compact sands to coarse nodular grits; and not unfrequently imbed cherty bands, nodular sandstones, and irregular deposits of fuller's earth, fossil wood, and ochre. In England the greensand is usually divided into Lower and Upper, because of the stiff

blue marly clays (gault) which occur about the middle of the group; but otherwise there is a great lithological similarity throughout its entire thickness, which rarely exceeds 400 or 500 feet. The *gault* or *golt* (a local term) is not of great thickness, nor very regular in its occurrence. It is a bluish chalky clay, which effervesces strongly on the application of acids; is interstratified with layers of greensand; and in some localities holds irregular balls of argillaceous ironstone, collected round ammonites and other shells. In some districts the gault assumes a reddish tint, from the iron it contains; but in other respects its composition is very persistent, and it rarely exceeds 80 or 100 feet in thickness. These three members—the Upper Greensand, the Gault, and the Lower Greensand—constitute the *Cenomanien*, the *Aptien*, and *Neocomien* (in part) of French geologists.—See CRETACEOUS SYSTEM.

Greenstone.—A general designation for the hard granular-crystalline varieties of trap, consisting mainly of felspar and hornblende, felspar and augite, or felspar and hypersthene. The term has reference to their greenish or blackish-green colours, and though not very precise, these shades very largely prevail. Compared with the Basalts, the Greenstones (*whinstones* of Scotland) are less compact, more granular, exhibit distinctly their component crystals, often contain sulphuret of iron, and are usually massive or tabular in their structure. It is customary to speak of them as hypersthenic greenstones, augitic greenstones, &c., according to the predominating mineral; and as many of them are porphyritic in their texture, we have *greenstone porphyries*, or *porphyritic greenstones.* Adopting Continental nomenclature, those exclusively composed of hornblende and felspar are termed *diorites;* those of augite and felspar, *dolerites.* On the whole, though the trap-rocks often differ little in composition, the *texture* of the Greenstone is always more granular or granitic than the basalts, never earthy like the tuffs and wackès, vesicular like the amygdaloids, nor glassy like the obsidians and pitchstones.

Grénatite (Fr. *grenat*, a garnet).—Prismatoidal garnet; known also as *Staurotide, Staurolite*, or *Cross-stone*, from the peculiar combination of its prisms.

Gres Bigarré (Fr.)—Literally "variegated sandstone;" the equivalent of the *Bunter Sandstein* of Germany, and the *Variegated Sandstones* or lower Trias of England.

Gres de Vosges.—The lowest member of the Trias or Upper New Red Sandstone of France, as extensively developed in the Vosges.

Greystone.—A variety of trachyte, of a lead-grey or greenish colour, and composed of felspar and augite—the felspar being more than 75 per cent of the admixture. "Greystone lavas," says Lyell, "are intermediate between basaltic and trachytic lavas."

Greywacké (Ger. *grauwackè*).—A German term originally employed to designate the grey-coloured argillo-arenaceous beds, or coarse slaty strata of the Transition rocks, and subsequently as a name for the entire transition series. It is now seldom employed in this sense—the "transition" rocks having been resolved mainly into the *Silurian*, and partly into the *Cambrian* and *Hypozoic* systems. It is still, however, used to designate the hard, gritty, brecciated, or breccio-conglomerate beds which occur in these formations; and, as a mere lithological term for these *ancient grits* and *breccias*, is by no means without its convenience.

Griffíthides.—One of the three genera of small trilobites (*Phillipsia,*

Griffithides, and *Brachymetopus*), the only examples yet discovered in the Carboniferous formation. Named after Sir R. Griffiths, the original expounder of the "Carboniferous slates," or Lower Coal-Measures of Ireland.

Grit.—Any hard sandstone in which the component grains of quartz are less rounded or "sharper" than in ordinary sandstones, is technically termed a *grit*—as millstone-grit, grindstone-grit.

Grossular, or Grossulaire.—The name given by mineralogists to the pale gooseberry-green varieties of translucent garnet.

Group.—An assemblage of objects having some resemblance or character in common; hence we speak of groups of strata, of minerals, of plants, and of animals.

Growan.—A mining term for decomposed granite. "The word," says Ansted, "is old Cornish, and appears to have originally meant a rock of uneven composition, whether a conglomerate, a mere gravel, a decomposed porphyritic rock, or solid granite. The expression *soft growan* is sometimes applied when the mineral is sandy.

Gryphæa, Grýphite (Lat. *gryps*, a griffin).—A sub-genus of the oyster family, abounding in the Lias, Oolite, and Chalk formations. It derives its name from the beak-like incurved umbo of its left or larger valve; the right being small, opercular-like, and concave.

Grýphite Limestone.—A term occasionally applied to the limestones of the Lias, from the marked predominance of the shells of the *gryphæa* in that formation.

Guáno.—A Peruvian term for the well-known manure obtained from the rocks and islets of the Pacific, and other rainless regions, favourable to the retention of the ammoniacal salts which constitute its principal value. It consists mainly of the droppings of countless sea-fowl, intermingled with their skeletons and eggs, the decomposed bodies and bones of fishes, seals, sea-lions, and other marine creatures frequenting these islands. Considering the immense thickness of some guano deposits (40, 60, and 80 feet), and their necessarily slow accumulation, the lower beds, geologically speaking, must be of vast antiquity—carrying us back to the very verge of the current era.

Gulf Stream.—One of the most important and influential of ascertained ocean-currents. It is generally considered as "taking its rise in the Gulf of Mexico (whence its name), though it may be regarded as a continuation of the mighty equatorial current, which sets out from the Western Coast of Africa, and, after a course of four thousand miles, enters the Caribbean Sea. Absorbing the sun's rays as it advances, it passes into that magnificent indentation in the Mexican coast which serves as a caldron; for there its waters are raised to the temperature of 86°. It then sweeps through the Pass of Florida—its heat being 9° more than the ocean can lay claim to, by reason of its latitude—and skirts the shores of North America, until it takes that remarkable bend off Nova Scotia and Newfoundland, which throws its waters towards the coasts of Europe. One branch curves downwards and flits past the Azores to the south; the other glides northward in the direction of the British Islands and the Polar Sea. This magnificent ocean-river is supposed to be equal in volume to three thousand Mississippis. Its length, reckoning from its Mexican head to the Azores, is upwards of three thousand miles. Its velocity in the Gulf of Florida is about 78 miles a-day, but its current dwindles down to a sober

flow of ten before it reaches the Azores. Its average velocity is about thirty-eight miles in the four-and-twenty hours. There are many peculiarities attached to this noble current. The colour of its waters is an indigo-blue as far as the coast of the Carolinas. Its margins, especially the left, are generally well defined; so that the voyager knows when he dips into its flood—the edge being made manifest by the ripplings which mark the line of division, as well as by other visible traits. It would appear, too, that this current actually runs up-hill, for the thermometer shows that the under part, in flowing from Cape Hatteras to the Capes of Virginia, makes an ascent of six hundred feet, being a gradient of five or six feet to the mile. It is noticeable, also, that the surface of this ocean-river slopes from the centre towards the margins, like the curve of a causeway, and thus boats and other objects, if left to themselves, naturally drift towards the edges. It is in this way that the Sargasso Sea (the expanse permanently covered with the *fucus natans*) has been formed—the weeds, like the drift on an eddy, floating always towards the still and lower level."

The great function of the Gulf Stream seems to be the equalisation of the superficial temperature of the globe. Acquiring in its fountain-head a temperature of 86°, and losing only some 13° or 14° in its progress, it diffuses a perennial supply of warmth, not only among the waters of the oceans, but throughout the atmosphere which passes over it, and over the countries along whose shores it travels. Thus, as its velocity slackens about mid Atlantic, it begins to diffuse itself over a wider area, and so counteracts the cold brought down by the Arctic Current. So perceptible is this, that while the sea beyond its influence is little above freezing, navigators, on fairly entering its waters, find the ocean gradually rise to 50° above freezing. As it diffuses itself, in virtue of its diminished velocity, it spreads over a wider area, and thus renders more genial a broader expanse of ocean; while the winds passing over it are tempered, and bear their balmier influences to wider regions. It is to the Gulf Stream that western Eurόpe, and Britain in particular, owes a higher mean temperature than other places in the same parallels of latitude; and so, also, while modifying the rigours of our European winters, it sends its surplus warmth to Arctic regions and the Polar seas. Cosmically, it is thus a great modifier and regulator of the Life of the ocean, as well as of the countries against which its genial current impinges—conferring on regions which are geographically sub-temperate, a truly temperate Flora and Fauna. Geologically, it gives us vast insight into those modifications of former climate which may have been brought about by other distributions of land and sea than those at present existing, and that without at all calling in the aid of those abnormal conditions of "internal heat," "change of earth's axis," and the like, under which the slenderly informed theorist too often takes shelter. —See MAURY'S *Physical Geography of the Ocean.*

Gurt (Sax.)—In Mining, a gutter or channel for water, usually hewn out of the "pavement" or bottom of a working drift.

Guyáquillite.—A fatty mineral occurring in friable amorphous masses of a pale-yellow colour, and melting at 157° Fahrenheit. It is found at Guyaquil in South America, and is very similar to the *bog-butters,* and other *mineral fats* of our own country.—See MINERAL RESINS.

Gýmnodonts (Gr. *gymnos,* naked, and *odous,* tooth).—A family of fishes belonging to the order *Plectognathi* (soldered jaws), and including the

globe-fish, trunk-fish, &c., in which the jaws are covered with a substance resembling ivory arranged in small plates, representing united teeth. The *gymnodonts* appear only in the Chalk and Tertiary formations.

Gýmnosperms (Gr. *gymnos*, naked, and *sperma*, seed).—Flowering plants with naked seeds (that is, whose ovules are not enclosed in a pericarp), and so called in contradistinction to the *Angiosperms*, whose seeds are enclosed. The gymnosperms, or *gymnogens*, as they are also termed, differ only in this respect from the *Exogens*, and consequently have their wood arranged in concentric layers; *e.g.*, the *Coniferæ* or Pine tribe.—See BOTANY.

Gypsum.—Sulphate of lime, plaster-of-Paris, or stucco-stone. The Greek word *gypsos* signifies lime in general, and seems to be derived from *gè*, the earth, and *epso*, I boil, in allusion to the heat given off when burnt lime is slacked with water. Gypsum is found in *crystals*, in *fibrous* masses, and in *granular-compact* beds, often of great extent. Its normal composition is 46.47 sulphuric acid, 32.65 lime, and 20.88 water. "It is a very common mineral," says Nicoll, "especially in the more recent sedimentary formations, and is even now forming, either as a deposit from water holding it in solution, or from the decomposition of iron-pyrites, when the sulphuric acid combines with lime, or from the action of sulphurous vapours in volcanic regions on calcareous rocks. It is often imbedded in nests or reniform masses in clay or marl, more rarely makes part of mineral veins, but seldom or ever forms veins by itself. The transparent crystals are termed *selenite*, and fine specimens occur in the salt mines of Bex in Switzerland, in those of the Tyrol, Salzburg, and Bohemia, in the sulphur mines of Sicily, at Lockport in New York, and other places in North America, in the clay of Shotover Hill near Oxford, at Chatley near Bath, and many other localities. Fibrous gypsum occurs of remarkable beauty at Ilfeld in the Harz, in the compact gypsum of northern Germany, and at Matlock in Derbyshire. Compact white gypsum or *alabaster* is found in great beauty at Volterra in Tuscany, and also in the Harz. Massive or compact gypsum forms whole beds in the trias and permian red sandstones of many parts of Germany, France, Italy, and England, and is often associated with rock-salt. In Nova Scotia it occurs with similar beds in the lower carboniferous formations. The fine varieties are cut into various ornamental articles, as vases, and the so-called *Roman pearls*, chiefly distinguished from the true pearl by their specific gravity. Plaster-of-Paris, used for casts and other works of art, is formed by calcining the mineral and grinding it down to a fine powder, which forms a paste that soon hardens by absorbing the water driven off by the heat. It, however, loses this property when exposed to a temperature above 300° Fahrenheit, when it becomes similar to *Anhydrite*. Gypsum is also used for glazing porcelain, and the formation of potters' moulds; in the manufacture of glass; as mortar and as manure, especially as a top-dressing for meadows."

Gyracánthus (Gr. *gyros*, a circle or spire, and *acantha*, a spine).—Literally "spiral or twisted spine;" a genus of ceatraciont fin-spines or ichthyodorulites occurring in the Carboniferous and Permian formations, often from ten to eighteen inches in length, and so termed from the sculptured ridges with which they are ornamented, and which run in a spiral or twisted-like manner, from the base upwards.

Gyration (Gr. *gyros*, a circle).—The act of revolving; a revolution.—**Gyratory**, having a revolving and twisting motion.

Gýrodus (Gr. *gyros*, a circle, and *odous*, tooth).—Literally "circle

tooth;" a genus of pycnodont fishes, occurring in the oolite and chalk, and so termed from their circular grinding teeth which are disposed in rows on the bones composing the roof, floor, and sides of the mouth. The fishes of this genus have the body large, flat, and elevated; the dorsal and anal fins long; the tail forked with unequal lobes; and the scales laterally connected by strong processes, as in *Lepidotus.*

Gyrogonítes (Gr. *gyros,* twisted, and *gonê,* seed).—The spiral seed-vessels of plants allied to the Chara, and found fossil in fresh-water tertiaries. "The *Charæ,*" says Lyell, "inhabit the bottom of lakes and ponds, and flourish mostly where the water is charged with carbonate of lime. Their seed-vessels are covered with a very tough integument, capable of resisting decomposition, to which circumstance we may attribute their abundance in a fossil state."

H

Haárkies (Ger. *haar,* hair).—A German term for the native sulphate of nickel, or *Millerite,* which occurs in very fine acicular and capillary crystals. It is known also as *Capillary Pyrites,* and consists of 64.76 nickel, and 35.24 sulphur.

Habitat.—Applied in Botany to the country or district in which a plant grows wild; the tract or range to which it seems limited by external conditions of soil, climate, &c.

Hackly.—Having the surface rough with irregular protruding points; a term applied to the fracture of rocks and minerals when they break up with a rough irregular surface, as certain greenstones and granites.

Hade, Hading.—A miner's term for the inclination or slope of any slip, fault, vein, or lode. The amount of deviation from the vertical is spoken of as the *hading;* and a fault or vein so sloping is said to *hade.*

Hæmatite or **Hématite** (Gr. *haima,* blood).—Native oxide of iron, so named from its prevailing reddish colour and blood-like streak. It is customary to speak of the *red* hæmatite and the *brown* hæmatite—the one being an anhydrous (70 iron, 30 oxygen), the other a hydrated peroxide of iron (85.6 peroxide of iron, and 14.4 water). The red hæmatite is an abundant ore, occurring in veins and beds in the older crystalline rocks, and passing from a state of sparry crystallisation (*specular iron*), through concentric kidney-shaped concretions (*fibrous red iron*), and compact or ochrey masses (*hæmatite* proper), to a soft earthy variety known as *reddle* or red-chalk. The brown hæmatite, often termed *Limonite,* occurs in beds, veins, and nests, in rocks of all ages, and also presents several varieties, as the *fibrous, compact,* and *ochrey.* It is frequently mixed with other mineral substances, such admixtures forming *umber, yellow-ochre, bog-iron,* and other well-known substances.—See Iron.

Haidingerite (after Haidinger the mineralogist).—A name given to two totally different minerals—the Haidingerite of Turner being a hydrous arseniate of lime (85.68 arseniate of lime, and 14.32 water); and that of Berthier being an ore of antimony, consisting of sulphuret of antimony and sulphuret of iron in varying proportions.

Halcyórnis (Gr. *halcyon*, the kingfisher, and *ornis*, bird).—An extinct bird, whose remains occur in the eocene beds of the isle of Sheppey; and so termed from its apparent affinities to the existing kingfisher.

Halithérium (Gr. *hals, halos*, the sea, and *therion*, beast).—Literally "sea-beast;" a tertiary cetacean having evident affinities to the phytophagous family of the *Manatidæ* or sea-cows.

Hálogene (Gr. *hals*, salt, and *gennao*, I produce).—A term employed by Berzelius to denote bodies which form salts with metals, as chlorine, bromine, iodine, fluorine, and cyanogen. The salts thus produced are termed *haloids*.

Haloid Salts (Gr. *hals*, salt, and *eidos*, resemblance). — Salt-like compounds consisting of a metal on the one hand, and of chlorine, iodine, and the radicals of the hydracids in general, excepting sulphur, on the other.

Halónia.—A genus of fossil stems apparently intermediate between the Lycopods and Conifers, and so called from its affinity, being nearest with *Halonia*. "It comprehends," according to Lindley, "all stems in which, to the surface of lepidodendron, is added the mode of branching of certain coniferæ." According to others, *Halonia* is merely the branches of *Knorria*, and is described as "stem not furrowed, branched, covered with indistinct rhomboidal marks, and tubercular projections disposed in quincunx order."

Halysítes (Gr. *halysis*, a chain).—Chain-pore coral; a genus peculiar to palæozoic strata, and better known as *Catenipora*, which see.

Hamite (Lat. *hamus*, a hook).—A genus of the Ammonite family peculiar to the Chalk and Greensand, and so named from the shell, which is hook-shaped, or bent upon itself more than once—the courses being separate. D'Orbigny separates the greensand from the chalk species, and erects them into a distinct genus under the title *Hamulina*.

Hardness of Minerals and Rocks.—In discriminating rocks and minerals, their *hardness* is one of the physical properties almost invariably made use of by the geologist and mineralogist. In Mineralogy, it is estimated by a conventional scale of ten degrees, invented by Mohs, who assumed talc to be the lowest in the scale, and diamond the highest, thus:—

Talc,	1	Adularia felspar,	6
Rock-salt,	2	Rock-crystal,	7
Calc-spar,	3	Topaz,	8
Fluor-spar,	4	Corundum,	9
Apatite,	5	Diamond,	10

If, for example, a mineral can be scratched by rock-crystal, but can in turn scratch felspar, it is evident its hardness lies between 6 and 7 of the scale, and may be expressed by 6.3 or 6.8, just as it seems to approach felspar on the one hand, or rock-crystal on the other. The hardness of minerals may also be tested by the application of a file or steel-point; and thus it is customary to say that talc can be scratched with the nail of the finger, that felspar yields to the knife, while rock-crystal resists it. In treating of rocks it is impossible to determine their hardness with the same precision, though quartz-rock may be regarded as standing at one end of the scale, and ordinary white chalk at the other. A very good test of the hardness and compactness of a rock is the sound that it emits when struck by the hammer—the harder yielding a sharp ringing sound, the softer a dull and heavy. It is thus that the French quarrymen estimate the quality of the celebrated Caen stone, their scale of hardness being indi-

cated by the expressive sounds *pif, paf, pouf*—the *pif* being the hard and compact, the *pouf* the soft and friable.

Hare.—Remains of the hare and rabbit have not yet been detected in deposits of older date than the pleistocene bone-caverns of England and the south of Europe.

Hármatome (Gr. *harmos,* a joint, and *tomè,* a section).—One of the Zeolite family, consisting of 48.3 silica, 17.8 alumina, 19.9 baryta, and 14 water, with traces of lime and potash. It is known also as CROSS-STONE, and derives its name from the joint-like intersection of its rhombic crystals. Associated with zeolite, &c. in the older metalliferous veins.

Hátchetine (after Mr Hatchett, the mineralogist).—Mineral tallow; a waxy or spermaceti-like substance of a greenish-yellow colour, faint pearly lustre, and translucent. Occurs in thin flaky veins in the iron-stone of Merthyr-Tydvil and other localities; consists of 86 carbon and 14 hydrogen; and is fusible, according to variety, at 115° to 160° Fahr.—See RESINS, MINERAL.

Háusmannite (after the mineralogist Hausmann).—Pyramidal manganese ore, occurring, with other manganese ores, either as a protoxide, or as a peroxide of that metal.

Hauyne (after the mineralogist *Haüy*).—One of the Haloid minerals, of a fine azure blue colour, and occurring in crystalline grains, in lava, and other volcanic rocks. Its average composition seems to be 34.8 silica, 28.9 alumina, 17.2 soda, 7.9 lime, and 11.2 sulphuric acid.

Headland.—Any projection of the land into the sea; generally applied to a *cape, ness,* or *promontory,* of some boldness and elevation.

Heart-wood.—A familiar term for the hard and matured interior portion of exogenous stems or timber-trees, in contradistinction to the *sap-wood* or soft, unmatured, exterior layers. Technically, the former is termed *duramen,* the latter *alburnum.*

Heave (in Mining).—The displacement of a vein or bed by the intersection of another vein or fault. When the intersected vein is thrown up, it is said to be a *heave,* and when thrown down a *slide.* Heave and slide are thus merely relative terms, according to the position from which they are viewed.—See FAULT and DISLOCATION.

Heavy-Spar.—A term often loosely applied to the carbonate as well as to the sulphate of baryta, and not unfrequently also to the carbonate and sulphate of strontia. Properly speaking, the "heavy-spar" of the mineralogist is the sulphate of baryta, occurring in veins massive, fibrous, lamellar, and in prismatic crystals. The rhomboidal carbonate is better known as *Witherite,* the carbonate of strontia as *Strontianite,* and the sulphate of strontia as *Celestine*—all of which see.

Hedenbérgite.—An important variety of lime-iron augite, of a black or blackish-green colour, named after M. Hedenberg.

Helianthoida (Gr. *helios,* the sun, and *anthos,* flower).—Literally "sunflowers;" the actiniform zoophytes which constitute an extensive order of the Anthozoa, and of which the *actiniæ* or sea-anemones may be taken as the type. The Helianthoids, except in the free species, as the Actinia, have a lamellated calcareous polypidom, the plates of which radiate (flower-like) from the centre; and these stony structures enter largely into the composition of coral-reefs, recent as well as fossil.

Helícidæ (Lat. *helix,* a coil).—The land-snails; a well-known family of vegetable-eating gasteropods, having a light, variously coloured, more or

less turbinated shell, and of which the garden-snail may be taken as the type. The Helicidæ, of which there are upwards of 1200 living species, have a world-wide range; the extinct species, about 50 in number, are found only in Tertiary and recent formations.

Helióceras, Heliocératite (Gr. *helix*, a spiral, and *keras*, horn).—A genus of the Ammonite family, ranging from the inferior oolite to the chalk inclusive, and so named from the spiral arrangement of its chambered whorls.

Heliolítes (Gr. *helios*, the sun, and *lithos*, stone).—An extensive genus of Silurian and Devonian corals belonging to the family *Milleporidæ;* and so called from the central-radiating, or sun-like aspect of the septa of their pores compared with those of the *Astræa* or star-corals.

Héliotrope (Gr. *helios*, the sun, and *tropè*, turning).—Bloodstone; a variety of calcedony of a dark-green colour, and sprinkled with deep red spots. The name is also applied by lapidaries to stones, some of which are agates and others jaspers—the *agate-bloodstones* being in greater part translucent, the *jasper-bloodstones*, on the contrary, being mainly opaque.

Helminthítes (Gr. *helminthos*, a worm).—Applied to those long sinuous tracks so common on the surfaces of many flaggy sandstones, and which are usually considered as worm-trails.

Hélodus (Gr. *helos*, a stud, and *odous*, tooth).—Literally "stud-tooth;" a genus of cestraciont fish-teeth occurring abundantly in the carboniferous limestone, and so termed from the stud-like aspect of their crushing crowns.

Hematite, more frequently HÆMATITE, which see.

Hemi— A Greek word frequently employed as a prefix to denote *half*, and synonymous with the Latin *semi;* as *hemi-sphere*, half a sphere; *hemiptera*, half-winged, &c.

Hemicídaris (Gr. *hemi*, half, and *cidaris*).—A genus of turban-echinites characteristic of the Upper Jura Limestone of Switzerland, and distinguished by its depressed form (*hemi*), and long sub-cylindrical spines. It occurs abundantly in the Oolites of England.

Hemicosmítes (Gr.)—Literally "half-sphere." A Lower Silurian cystidean, characterised by its spherical form, composed of numerous hexagonal and pentagonal plates; central, proboscidiform mouth; and absence of tentacles or arms. Originally known as *Echinosphærites.*

Hemipneustis (Gr. *hemi*, half, and *pneustis*, blown).—M. Agassiz' generic term for the fossil sea-urchin *Spatangus*, in allusion to its *flattened* or *half-inflated shape.*—See SPATANGIDÆ.

Hemiprístis (Gr. *pristis*, a saw).—A provisional genus of shark's teeth occurring in the Chalk and Tertiary formations. They are distinguished by their serrated edges, that do not extend to the summit, which is sharply pointed.

Hemitelites (Gr. *hemiteles*, half-finished, incomplete).—A term employed by Goeppert to designate certain Oolitic ferns, because of their abruptly terminating (incomplete-looking) pinnules. The *Phlebopteris* of Professor Lindley, which see.

Hepátic (Gr. *hepar*, the liver).—Applied in Mineralogy to various substances of a *liver-like* colour and consistency; as *Hepatic pyrites*, a variety of prismatic iron pyrites which, on exposure to the atmosphere, is gradually converted from a yellow sulphuret to a liver-brown compact oxide of iron,

still retaining the original crystallised form; *Hepatic cinnabar,* a variety of cinnabar of a dark liver-colour, passing into steel-grey.

Hépatite (Gr. *hepar,* the liver).—A dark-grey variety of heavy-spar or sulphate of baryta, which, when rubbed, emits a fetid odour like sulphuretted hydrogen. It seems a mere mixture of barytes with carbonaceous matter.

Herbáceous.—Applied in Botany to stems that die down annually, in contradistinction to *ligneous* or woody, persistent stems.

Herbívorous (Lat. *herba,* herb, and *voro,* I devour).—Herb-eating; subsisting on vegetable food; in contradistinction to *carnivorous.*

Hermétically Sealed.—Sealing or closing-up by fusion; as the closing of a glass-tube by melting the ends. Said to be derived from the Egyptian Hermes, the fabled father of Chemistry.

Herpetíchnus (Gr. *herpeton,* a reptile, and *ichnon,* footprint).—A provisional term employed by Sir W. Jardine for certain small lizard-like footsteps occurring on the New Red Sandstone slabs of Corncockle Muir, Dumfriesshire, of Storeton, Cheshire, and similar localities.

Herpetólogy (Gr. *herpeton,* reptile, and *logos,* discourse).—That branch of Zoology which treats of the structure, habits, history, and arrangement of reptiles.

Hetero— (Gr. *heteros,* the other, not the same).—A term often employed in composition to denote difference or dissimilarity, as *homo* indicates sameness or similarity. Thus *hetero-geneous,* composed of different materials; *hetero-cercal,* having unequal lobes, like the tail of the dog-fish, &c.

Heterocércal (Gr. *heteros,* other, not the same, and *cercos,* tail).—A term applied by Agassiz to fishes having unequally-lobed tails, that is, where the rays are principally developed on the under side, and the vertebræ are produced far beyond, forming an upper and prominent lobe, as in the sharks and dog-fishes. Existing fishes have chiefly *homocercal,* or equally-lobed tails, as the herring, cod, salmon, &c.; several have undivided or *single* and rounded tails, as the wrasse; while the unequally-lobed or *heterocercal* tail is found only in the sharks, sturgeons, lepidosteus, and a few others. In the Palæozoic periods, however, the heterocercal form alone prevailed, no fish with a true homocercal tail occurring below the Triassic formation.

Héulandite (after Mr Heuland). — Foliated or tabular zeolite; the *Stilbite* of Haüy. Occurs chiefly in amygdaloid and other trap rocks; is generally white, but often of reddish or hair-brown colour; and consists of 58.1 silica, 18.4 alumina, 7.5 lime, aud 16 water.

Héxagon (Gr. *hex,* six, and *gonia,* an angle).—A figure with six angles, and consequently having six sides. *Hexagonal,* six-sided.

Hexágonal (Gr. *hex,* six, and *gonia,* an angle). — Applied to figures having six angles, and consequently six sides, more or less regular. Basalt occasionally appears in *hexagonal* or six-sided columns.

Hexaprótodon (Gr.)—Literally "six-front-teeth;" the generic term for a large pachyderm whose remains occur in the Pliocene and Miocene tertiaries of Asia. It was, according to Owen, "essentially a hippopotamus, with *six* incisor teeth, instead of *four,* in each jaw."

Highgate-Resin.—A familiar term for a species of fossil gum-resin or copal found in nodular masses in the tertiary clay at Highgate, near London.

Hippopótamus (Gr. *hippos,* horse, and *potamos,* river).—A well-known amphibious pachyderm now restricted to the rivers and swampy lakes of

Africa, but whose remains are found abundantly in the Pleistocene or uppermost tertiaries of England, France, Germany, and Italy. These remains, which occur in Pliocene, Pleistocene, and recent deposits, seem to indicate the existence of several species, and some of these of more gigantic dimensions than the living animal.

Hippothérium (Gr. *hippos,* horse, and *therion,* wild beast).—A mammal of the Miocene tertiaries, so called from its close resemblance to the Horse family. Remains from the Siwalik Hills indicated a size about that of the fallow-deer, with extreme length and slenderness of limb.

Híppurite (Gr. *hippos,* horse).—A massive horse-hoof-like bivalve of the chalk formation, having a deep conical or sub-cylindrical under-valve, with a flattish lid or upper-valve. As a family the *Hippuritidæ* have no living analogues; hence the diversity of opinion that has been expressed as to their true relations. The family embraces the *hippurites, radiolites, caprinella, caprina, caprotina,* &c.—all very peculiar in form, and highly characteristic of the Lower Chalk both in Europe, Northern Africa, and America; hence the occasional Continental term of the "Hippurite limestone" for the calcareous beds of that formation. For the structure and affinities of the Hippuritidæ, see S. P. Woodward in the 11th vol. of the *Geological Journal.*

Hippurítes.—A genus of coal-measure plants, so called from their close resemblance to the common *hippuris vulgaris,* or mare's-tail of our marshes. If they grew in the same relative proportions as the existing hippuris, many of the fragments found would indicate a height of eighteen or twenty feet. Very little, however, is known of their habits or true affinities.

Holáster (Gr. *holos,* entire, and *astron,* star).—A genus of Spatangidæ (which see) established by Agassiz for those echinites that are heart-shaped, with simple ambulacra converging towards the summit. The mouth is elongated transversely, and the vent is on the posterior face. The species are common in the Lower Chalk and Chalk-marl of England.

Holéctypus (Gr. *holos,* entire, wholly, and *ektypos,* moulded or embossed).—"In certain kinds of *Galerites* (fossil sea-urchins) the shell is strengthened internally," says Mantell, "by five strong ribs or projections, which of course leave corresponding deep furrows or channels on the flint casts moulded in them;" hence the name. These echinites have been erected by M. Desor into the genus *Holectypus,* the characteristics of which are—shell hemispherical and circular; the base flat; the tubercles disposed in series; the inside of the case supported by five lamellæ or ribs.

Holopéa (Gr. *holos,* entire, and *opê,* opening).—Literally "entire-mouth;" an obscure genus of Lower Silurian Gasteropods; periwinkle-like in contour, and hence formerly regarded as a form of *Littorina.* Outer lip situated near the base.

Holopélla.—Another obscure genus of Silurian Gasteropods; *turritella*-like in form, and hence originally ranked under that genus. Peristome *entire,* not produced in front.

Holoptýchius (Gr. *holos,* entire, and *ptychê,* wrinkle).—Literally "All-wrinkle;" a genus of sauroid fishes belonging to the Devonian and Carboniferous periods, and so called from the corrugated or wrinkled surfaces of their enamelled scales. They belong to the *Cœlacanthi* or hollow-spines; and judging from the bones of the head and the dorsal and fulcral scales, which are often from three to five inches in width, many of them must

have been of great size—from eight to ten or even twelve feet in length. In some species the wrinkles or furrows on the scales are disposed in labyrinthine fashion, in others they radiate in dichotomising lines from the anterior to the posterior margin, and in others again they are arranged in somewhat concentric order. Besides being armed with numerous sharp-pointed fish-teeth, their jaws were furnished with larger reptilian teeth of conical form placed at intervals in either jaw, evidently for the purpose of seizing and cutting up their bulkier prey. In the Carboniferous genus *Rhizodus*, which has been separated from the *Holoptychii*, the teeth are larger, compressed laterally, and more trenchant in form, while the scales also are larger and stronger, and covered with irregular granular corrugations. As yet the chief localities for Holoptychius have been the middle and upper Devonian sandstones of Elgin, of the Carse of Gowrie, and of Dura-Den in Fife; and the lower carboniferous strata of Fife, Mid-Lothian, and Lanark in Scotland, and of Armagh in Ireland. Though remains are abundant enough, much yet remains to be done for the rigid determination of the so-called species.

Homalonótus (Gr. *homalos*, on the same level or plane, and *notos*, the back).—A genus of trilobites occurring in Silurian and Devonian strata, and so termed because the three-lobed aspect so characteristic of the family is in a great measure obliterated, and the back appears smooth and uniform.

Homo— (Gr. *homos*, one and the same).—A term often employed in composition to denote similarity or sameness, as *hetero* indicates difference or dissimilarity. Thus, *homogeneous*, consisting of similar parts or properties; *homologous*, having the same ratio or proportion.

Hômocércal (Gr. *homos*, alike, and *cercos*, tail).—A term applied by Agassiz to those fishes which have equally-bilobate tails, as the herring, cod, salmon, &c., in contradistinction to those that are unequally lobed or *heterocercal*, like sharks and sturgeons. In geological formations, the homocercal tail is not known till the Oolitic period—all the palæozoic fishes being heterocerques.

Homœsólen (Gr. *homoios*, similar, and *sōlen*, a tube).—A delicate branching coral of the Chalk formation, composed, according to Lonsdale, "of large and small tubes of similar form, all inclined in the same direction, partially visible on the surface, and limited to one side of the coral; mouths simple tubular extremities; back without pores, and forming a continuous lamina."

Homológue, Homólogous (Gr. *homos*, the same, and *logos*, reasoning).—"Analogue" has reference to *similarity of function*, as the wing of the bird and the dermal expansion of the bat, because they each enable their respective possessors to fly, or sustain themselves in the air. Homologue, on the other hand, has reference to *identity of parts*, as the bone of the fore-limb, or "humerus," whether it occurs in the arm of man, the wing of a bird, the paddle of a whale, or the fore-leg of the horse.—See ANALOGUE and AFFINITY.

Homólogy (Gr. *homos*, the same, and *logos*, reasoning).—In general terms, the idea or doctrine of the answerable relation of parts in animal structures; *e.g.*, the bones of the human arm and hand find their homologues or answerable parts in the wing of the bird, in the fore-limb of the quadruped, and in the paddle of the whale—the identical parts being modified, fused together or atrophied, so as best to answer the functions or economy of the animal. As with the homologies of the *vertebrate* skeleton or bones, so

also with regard to the crust or outer-skeleton and its appendages in the *articulata;* and so also, as science advances, "the next important step (remarks Professor Owen) will be to determine the homologous parts of the nervous system, of the muscular system, of the respiratory and vascular system, and of the digestive, secretory, and generative organs in the same primary group or province."—See Owen's *Archetype of the Skeleton,* and Ogilvie's *Master-Builder's Plan,* for the doctrine of Homology.

Hone (Sax. *hoen*).—Whet-slate; whet-stone. The best hones, or *oil-stones,* as they are generally termed by the workmen using them, are obtained from those varieties of talc-slate which are sufficiently compact, and in which the particles of quartz are extremely minute and regularly disseminated, so as to give them a uniform consistence. Among the varieties most prized are—the *Turkey oilstones,* obtained from the interior of Asia Minor; the *German razor hone,* from the slate hills in the neighbourhood of Ratisbon; the *Arkansas oilstone,* from North America; the *Water-of-Ayr* or *Snakestone,* chiefly used for polishing copper plates; the *Welsh* and *Devon oilstones;* the *Charnley Forest oilstone,* from Leicestershire; and the *Norway ragstone,* of a coarser and keener texture than the ordinary hones or oilstones.

Honeystone.—A popular synonym of *mellite* or *mellilite,* which derives its name from its honey-yellow colour.—See MELLITE.

Hornblende.—The *amphibolé* of Haüy.—A simple mineral of frequent occurrence in granitic and trappean rocks; so called from its horn-like cleavage and peculiar lustre (*blenden,* to dazzle). In Mineralogy it is often taken as the type of a family under which are arranged *hornblende, augite, hypersthene, bronzite, diallage,* &c.; and lithologically it enters largely into the composition of many of the granites, syenites, greenstones, and porphyries. Of Hornblende proper there are several varieties (tremolite, actynolite, asbestos, &c.), the ordinary or common variety being of a black or dark-green colour, and occurring in flat prismatic crystals, in fibrous and radiated aggregates, or in lamellar granular masses. Analyses also show considerable variations in composition, the chief ingredients being silica (46 to 60), magnesia (14 to 28), lime (7 to 14), with minor proportions of iron protoxide, alumina, and fluoric acid. It is softer than quartz or felspar, but heavier than either: it is also heavier, and contains more silica, but is softer and more fusible than augite; its lamellar structure and softness distinguish it from schorl; and it emits a peculiar bitter odour when breathed on. It generally occurs confusedly crystalline, forming with quartz "hornblende rock," which is massive, and "hornblende schist," which is fissile and slaty; with quartz and felspar it forms "syenite;" and with felspar alone, the numerous varieties of "greenstone." As a mineral, hornblende is often confounded with augite, and from their similarity it has even been proposed to unite them into one species. "The former, however (as has been well remarked by Prof. Nicoll) contains more silica, and Bonsdorf has found in it from ½ to 1 per cent of fluoric acid, which does not appear in the latter. Hornblende, too, is more fusible than augite, and ranges lower in specific gravity. Though both possess a cleavage parallel to their vertical prisms, yet these differ in angular dimensions, and both are never observed in the same individual. These minerals also occur in distinct geognostic positions: hornblende in rocks containing quartz or free silica, and mostly with minerals that are neutral compounds of silica, as orthoclase and albite; augite in rocks that

do not contain free silica, and mostly with minerals that are not neutral silicates, as labradorite, olivine, and leucite. Hence there are two distinct series of massive or igneous rocks—the *hornblende series,* including granite, syenite, diorite, diorite porphyry and red porphyry ; and the *augite series* or hypersthene rock, gabbro, dolerite, nepheline rock, augite porphyry, and leucite porphyry."—See tabulations, "Mineral Scheme."

Hornítos or **Hornos.**—Literally *ovens ;* a Spanish term for the low oven-shaped mounds or hillocks so frequent in the volcanic districts of South America, and from whose sides and summits columns of hot smoke and other vapours are usually emitted. They are only a few feet in height (five to ten), and, according to Humboldt, are not *eruptive cones,* but mere intumescences on the fields and sides of the larger volcanoes. They occur in vast numbers, sending up their dense hot vapours to the height of twenty or thirty feet, and in many of them a subterranean noise is heard, which appears to announce the proximity of a fluid in ebullition.

Hornstone.—A mixed siliceous mineral and rock of various colours, having a dull splintery or sub-conchoidal fracture, and very much the aspect of a tough massive flint or chert. Indeed it is often difficult to distinguish between jasper, flint, and hornstone, though the latter term is more properly applied to all compact, tough, and massive varieties of siliceous rock, having in general a tendency to the slaty structure, and in the small fracture less translucent than the flints and jaspers. It consists chiefly of silex, with a varying proportion of alumina, and differs from the felspars in containing neither soda nor potash; hence its infusibility. A common igneous rock, consisting of hornstone, with imbedded crystals of quartz or felspar, is known as *hornstone porphyry.*

Horse.—Remains of the existing genus *Equus* are not known in deposits of earlier date than the Pleistocene or uppermost Tertiary epoch. Bones and teeth of more than one species occur in the alluvia, osseous breccias, and bone-caves of Europe, Asia, and America, although in the latter continent the horse was extinct at the period of its discovery by Columbus. A closely allied form (*Hippotherium*), distinguished by the extreme length and slenderness of its limbs, and about the size of a common deer, occurs, however, in the Siwalik deposits associated with the gigantic pachyderms, ruminants, and carnivora of that celebrated region.

Horses' Teeth.—A quarryman's term for the large independent crystals of felspar which occur in the granites of Devon and Cornwall, and give to them their well-known porphyritic character. The term has reference to the elongated shape and whitish colour of these crystals.

Humbóldtilite (after Humboldt).—A rather rare mineral, occurring in thick tabular or short prismatic crystals of a pale honey colour in the ejected blocks on Mount Vesuvius. Consists, according to Von Kobell, of 43.96 silica, 11.20 alumina, 31.96 lime, 6.10 magnesia, 2.32 iron peroxide, 4.28 soda, and a trace of potash.

Humboldtíne.—Known also as *Oxalite.* A native oxalate of iron occurring in yellowish capillary crystals in the brown coal of Germany.

Humite (after Sir A. Hume).—A variety of *Chondrodite.* A gem of a transparent vitreous brown colour, found in the ejected masses of Monte Somma, Vesuvius.

Hummock (Sax., a knoll or mound).—Applied by sailors to blocks and masses of ice which have been frozen together so as to produce a rugged and uneven surface of the general ice-field.

Humus (Lat. *humus*, the soil).—When wood or woody-fibre is exposed to the action of air and moisture, it suffers *eremacausis* or decay, and crumbles down into a black or dark-brown powder commonly called *vegetable mould*, and to which chemists give the name of *humus*.—See EREMACAUSIS.

Hurónian.—A term applied by Sir W. Logan and the Canadian geologists to a vast formation of strata (in parts metamorphic) of siliceous sandstones and chloritic and quartzose schists, characterised by the absence of organic remains and the presence of a great abundance of iron ore. These strata are regarded as the equivalents of the Cambrian system, and are typically developed in the vicinity of Lake Huron, whence the name.

Hýacinth.—A variety of pyramidal zircon, of a brilliant hyacinth-red. It is esteemed one of the gems, and is usually found in alluvial sands and gravels along with rubies, sapphires, and the like.—See ZIRCON.

Hyæna.—Bones, teeth, and the fossil excrement (*album græcum*) of hyænas are common in all the ossiferous caverns and breccias of Europe—some of these remains indicating species larger and more powerful than any of the existing species of Africa.

Hyáenodon.—A carnivorous quadruped about the size of a large hyæna or leopard, found in the eocene and miocene tertiaries of Europe, and specially characterised by its flesh-cutting teeth (carnassials), which, "instead of being one in each ramus of the jaw, as in modern felines, were three in number, and equally fitted by their trenchant shape to act like scissor-blades on the teeth of the upper jaw, in the act of cutting flesh."

Hýaline (Gr. *hyalos*, glass).—Glassy; having the lustre and transparency of glass.

Hýalite (Gr. *hyalos*, glass, and *lithos*, stone).—Glassy opal. A variety of opal found in transparent, colourless, very glassy, small concretions or incrustations in vesicular basalt and basaltic greenstone.

Hyalosíderite (Gr. *hyalos*, glass, and *sideros*, iron).—A brown or yellow-coloured, very ferruginous and metallic-looking variety of olivine.

Hýbodus, Hybodónts (Gr. *hybos*, a hump, and *odous*, tooth).—Intermediate between the Cestracionts with obtuse crushing teeth, and the Squaloids with sharp, angular, and pointed ones, are those fishes which Agassiz has arranged in a sub-family or group under the title *Hybodonts*. The teeth are the principal parts yet known, and these are transversely elongate, and furnished with a series of sub-conical cusps or knobs which compose the crown; hence the name. Teeth and spines of the genus are common in the Trias, Oolite, and Chalk systems—the former being readily distinguished by their knobbed crowns—the principal cusp or hump being in the centre.

Hybrid (Gr. *hybris*, wanton excess, lascivious assault).—The offspring of two nearly allied species, whether animal or vegetable—*e.g.* the mule, which is a hybrid between the horse and the ass. In the animal kingdom hybrids are naturally of very rare occurrence; and in the vegetable kingdom they are for the most part produced by artificial fecundation; that is, by crossing two species of the same genus, or two varieties of the same species—the *pollen* or fertilising principle of the one being applied to the pistil of the other.

Hydr— or **Hydro—** (Gr. *hydor*, water).—A common prefix denoting the presence, action, or quality of water; also the presence of HYDROGEN in

certain chemical compounds; as *hydro-silicite,* a mineral composed of silica and water; *hydr-aulic* press, an apparatus acting by the pressure of water; *hydraulic* cement, mortar that sets or hardens under water; and *hydro-carbon,* a compound of hydrogen and carbon.

Hydrárgillite (Gr. *hydor,* and *argilla,* clay).—A rarish mineral occurring in small hexagonal crystals, and, as the name imports, composed of alumina and water. Some specimens, however, yield a small per-centage of phosphoric acid, thus making it a *phosphate of alumina.*

Hydrates (Gr. *hydor,* water).—A term applied to compounds containing water in a state of chemical combination, and in definite proportions; as *hydrate of lime* (slaked lime); *hydrated oxide of iron* (iron rust).

Hydraulic Cement.—Any cement or mortar which sets or becomes hard under water. Common lime does not possess this property; but limestones containing from 10 to 25 per cent of alumina, magnesia, and silica, yield a lime on burning, which does not slake when moistened with water, but forms a mortar with it, which hardens in a few days when covered by water. *Puzzuolana, septaria,* certain *argillo-siliceous limestones* and *calcareous earths,* burnt either with or without the addition of common limestone, form the usual "hydraulic cements."—See CEMENTS.

Hydro-Carbons, Hydro-Carburets.—Composed of hydrogen and carbon. A term usually applied to the bitumens, mineral-resins, and mineral-fats, which are chiefly or altogether composed of hydrogen and carbon in varying proportions; as naphtha, petroleum, asphalt, amber, ozokerite, &c.

Hýdrogen (Gr. *hydor,* and *gennao,* I produce).—Literally "water-former;" one of the elementary gases which occurs most generally and abundantly in combination with oxygen, in the form of *water*—water being composed of eight parts by weight of oxygen and one of hydrogen, or of one volume of oxygen and two of hydrogen. As a simple substance hydrogen is colourless, and has commonly a slight odour of garlic; is not absorbable by water; is devoid of taste, and is destructive of life when breathed for any time. It is the lightest of all known bodies—100 cubic inches weighing only 2.25 grains, or being nearly thirteen times lighter than atmospheric air (as 69 to 1000), and exactly sixteen times lighter than oxygen. It is combustible, and when pure burns with a pale-blue flame; hence the early terms "inflammable air," and "phlogiston." In nature hydrogen is an abundant substance, and next to oxygen enters most largely into the composition of the earth's crust. In common with other gases, it is evolved by volcanic vents; as light carburetted hydrogen or fire-damp it is discharged from coal mines and other openings in connection with coaly strata; in combination with carbon it forms the *hydro-carburets,* naphtha, petroleum, bitumen, &c.; and as sulphuretted hydrogen it is largely discharged by volcanoes, and evolved by organic substances in the process of decay.

Hydrógraphy (Gr. *hydor,* and *grapho,* I write).—That branch of Geography which treats of the waters that form part of the surface of the terraqueous globe—as streams, rivers, lakes, seas, and the great ocean.

Hydróida (Gr. *hydra,* and *eidos,* hydra-like).—The Hydroid or Hydraform polypes; an extensive order of zoophytes occurring singly and independent, or in compound groups. In the compound species the body is implanted in a horny tubular sheath, and the polypidoms form branched corallines, which are fixed at the base to rocks, sea-weeds, and shells. The order embraces the *Hydridæ, Sertularidæ,* and *Tubularidæ;* and under

the same head palæontologists would also arrange the extinct *Graptolites* of the Silurian epoch.

Hydrólogy (Gr. *hydor*, and *logos*, discourse).—That department of science which treats of water in all its properties, manifestations, and relations in the economy of nature.

Hydromágnesite.—Native carbonate of magnesia occurring in white, earthy, amorphous masses in serpentinous rocks, and consisting of 36.2 carbonic acid, 44 magnesia, and 19.8 water.

Hydropháne (Gr. *hydor*, and *phaino*, I appear).—A variety of cachalong-opal, which is pearly-opaque when dry, but becomes transparent when saturated with water; hence the name.

Hydrophýtes (Gr. *hydor*, and *phyton*, a shoot).—Literally "water-plants;" a term occasionally applied to the *algæ*, *fuci*, and other strictly aquatic vegetation, whether fresh-water or marine. They occur fossil in all formations, but generally in states too imperfect to permit of being classed with existing families.

Hygrómeter (Gr. *hygros*, moist, and *metron*, a measure).—An instrument for measuring the amount of moisture in the atmosphere.

Hýgroscope (Gr. *hygros*, and *scopeo*, I perceive).—An instrument for indicating the presence of aqueous vapour in the atmosphere, without measuring its exact amount.

Hylæosáurus (Gr. *hyla*, a wood, *weald*, or forest, and *saurus*, lizard).—One of the Dinosaurs; a gigantic terrestrial reptile whose remains were first discovered (1832) by Dr Mantell in the Wealden strata of Tilgate Forest; hence the name. "The Hylæosaurus," says the discoverer, "so far as the size and form of its body may be inferred from the remains of the skeleton hitherto discovered—for of its head and jaws nothing is at present [1851] known—probably attained a length of from twenty to thirty feet. The body was broader than high, and terminated in a long slender flexible tail; the limbs were relatively short; the skin was covered with scutes and tubercles; and a row of very large, thin angular spines extended down the back, and formed a serrated dermal crest. The coracoids, scapulæ, and ribs, indicate a pectoral arch, in which were blended the osteological characters of the Monitors and Crocodilians." The Hylæosaurus, we may add, occupies a prominent place among the Palæontological restorations in the Crystal Palace Gardens.

Hymenócaris (Gr. *hymen*, membrane, and *caris*, shrimp). — A small phyllopod or shrimp-like crustacean of the Silurian epoch, having its anterior portion enclosed in a thin bivalvular carapace, and its abdominal or terminal segments free and capable of being turned under the body.

Hyopótamus (Gr. *hys*, *hyos*, a hog, and *potamos*, river). — Literally "river-hog;" a non-ruminant, even-toed (*artiodactyle*) mammal, whose remains occur in the Tertiary strata of England and France. Described by Professor Owen (*Geological Journal*, vol. iv.), who regards it as allied to the *Anthracotherium*, *Chæropotamus*, and other hog-like mammals of that period.

Hyp— or **Hypo**— (Gr. *hypo*, under).—A common prefix in scientific terminology signifying *under* or *below*, in reference to place or position, and indicating *deficiency* or *less than* when applied to quality or composition; as *hypogene*, formed below; *hyponitrous acid*, an acid intermediate between nitric oxide and nitrous acid. Synonymous with the Latin prefix *sub*.

Hypanthocrínus (Gr. *hypantheo*, to begin to flower).—A genus of Rose-encrinites, occurring in Upper Silurian strata, and so termed from the flower-like contour of its ornamented receptacle and bifurcating arms. The column is cylindrical, but traversed internally by a pentagonal canal.

Hyper— (Gr. *hyper*, above).—A frequent prefix in scientific terminology, signifying *above* or *upon*, in reference to place or position, and indicating *excess*, with regard to quality or composition. Thus, *hyperthyrum*, the lintel or over-piece of a doorway; *hypercriticism*, exaggerated or excessive criticism; *hypertrophy*, a morbid enlargement of any organ as if from excess of nutrition. Synonymous with the Latin prefix *super*.

Hýpersthene (Gr. *hyper*, above or excess, and *sthenos*, strength).—A mineral of the Hornblende family, so called from its power of resisting acids as compared with augite, to which it is closely related—the "prismatoidal schiller-spar" of Mohs, and the "Labrador hornblende" of other authors. It occurs massive, in crystalline and granular aggregates, or disseminated; has a vitreo-resinous lustre, but pearly-metallic on the principal cleavage-planes; and has usually a pinchbeck-brown or greyish-green colour, passing into black. It is a ferrosilicate of magnesia, with traces of alumina and lime, and differs in this respect from augite, which contains from 18 to 24 per cent of lime. It is a constituent of several rocks, forming, with labradorite, "hypersthene rock;" with labradorite and chlorite, "diabase;" and it occurs also in the euphotide or "gabbro." Hypersthene rock is common in primary districts, and in Sweden the finer varieties are polished as an ornamental stone.

Hypogéne (Gr. *hypo*, under, and *ginomai*, I am formed).—"As all the crystalline rocks," says Lyell, "may, in some respects, be viewed as belonging to one great family, whether they be stratified or unstratified, plutonic or metamorphic, it will often be convenient to speak of them by one common name. For this purpose I propose the term 'hypogene'—a word implying the theory that granite, gneiss, and the other crystalline formations, are alike *nether-formed* rocks, or rocks which have not assumed their present form and structure at the surface. They occupy the lowest place in the order of superposition. Even in regions such as the Alps, where some masses of granite can be shown to be of Tertiary epoch, they are still *underlying* rocks."

Hypozóic (Gr. *hypo*, under, and *zoê*, life).—Applied to those rocks which, like gneiss and mica-schist, lie beneath the undoubtedly fossiliferous strata, and which have yet yielded no organic remains. "Azoic," which is also applied to these rocks, means destitute of fossils; "hypozoic" simply points out their position, without offering any opinion as to their fossiliferous or non-fossiliferous character.—See tabulations, "Geological Scheme."

Hýpsodon (Gr. *hypsos*, height, and *odous*, tooth).—Literally "tall-tooth;" a genus of saury-pikes (*scomber-esocidæ*) occurring in the Chalk of Kent and Sussex, and so termed from their extremely upright, long, conical, compressed and pointed teeth. The teeth and fragments discovered indicate fishes of a very large size.

Hyracothérium (Gr. *hyrax*, the hare-rat or cony, and *therion*, beast).—A small pachydermatous mammal, occurring in the Tertiary strata of England, and so termed by Professor Owen (*Foss. Mammals*), from its apparent relationship to the *Hyracidæ* or Conies of Southern Africa. The genus stands intermediate between the Hog and Hyrax; and the species range from the size of a rabbit to that of a large hare.

I

Ice (Sax.; Ger. *eis*).—The familiar as well as technical term for *frozen water*, or water converted into the solid state under the influence of extreme cold. Water is at its minimum volume when about 40° Fahr., and above or under this temperature it increases in bulk—passing into steam on the one hand, and being converted into ice on the other. At 32° or under, it exists in the condition of ice; and this ice, being greater in volume than the water of which it is composed, is lighter, and consequently floats on the surface. It is owing to this expansion of water that frost becomes such a powerful agent in the disintegration of soils and rock-masses—the water in their interstices being converted into ice, and irresistibly breaking asunder the cohesion of their parts. It is also owing to this lightness and floating power that we have the phenomena of *ground-ice* lifting up and transporting masses of shingle and sand—of *icebergs* floating their burdens of boulders and rock-debris, and scattering them over the bed of the ocean—and of *avalanche* and *glacier* wasting, smoothing, and moulding into new forms the contours of all Arctic and Alpine mountains.—See FROST.

Iceberg (Ger. *eis*, ice, and *berg*, mountain).—The name given to the mountainous masses of ice often found floating in polar seas. Sometimes they are formed by the accumulation of ice and snow on the surface of the water; at other times they seem to have been originally glaciers launched from precipitous coasts into the ocean, and there further augmented by numbers of them freezing *en masse.* These "fields" or "packs" are often of great extent—stretching across the ocean as far as the eye can reach, and rising in perpendicular cliffs from 80 to 100 or 150 feet above the water. Solitary or independent icebergs are also often of vast dimensions, and instances are given, both in Arctic and Antarctic voyages, of *bergs* several miles in circumference, rising from 40 to 200 feet above the sea-level, and loaded with blocks of rocks and shingle. Some idea of their size may be formed from the fact that little more than an eighth of their bulk rises above the surface—the greater portion being submerged and apt to be grounded on shoals and flats. As they are floated by the polar currents to warmer latitudes they melt away, dropping their burdens of boulder and rock-debris on the bottom of the ocean. Could we lay bare this sea-bottom, we should find appearances strictly analogous to the "drift" or "boulder-clay" of geologists; and it is in this way that the boulder-clay or Northern Drift, with its water-worn blocks, its gravel and shingle, its smoothed and furrowed rock-surfaces, and other kindred appearances, can alone be accounted for. At the present day icebergs are familiar phenomena both in arctic and antarctic seas—those of the north being seldom carried southward beyond the 44th parallel of latitude, while those of the south are not unfrequently found northward as far as the Cape of Good Hope, or on an average at 10 degrees lower latitude. As the *glacier* smooths and furrows the rocks over which it passes, so the *iceberg*, with its immense weight and greater motion, grinds, and rubs, and ploughs; and while the one lays down its lateral and terminal moraines in ridge-like mounds, the other

carries from the cliffs and shores its mud, and gravel, and boulders, and strews them along the bottom of the ocean.

Ice-floe (Dan., ice-island).—Applied by voyagers to the smaller masses of ice that encumber the polar seas. Floes are rarely a quarter of a mile in circumference, and usually much smaller.

Iceland-Spar.—A variety of calcareous spar remarkable for its transparency and double refraction. According to Nicol, it is not found in crystals, but occurs massive in a trap-rock in Iceland, and has been considered as a portion of altered limestone.

Ice-Spar.—A familiar term for a variety of orthoclase or common prismatic felspar; transparent or translucent; colourless and white, or but slightly tinged with grey or faint yellowish-green; and of a vitreous or glassy lustre.—See FELSPAR.

Ichnítes (Gr. *ichnos*, a footprint).—A term applied to all fossil footprints, many of which have been discovered in palæozoic and secondary formations—as *ornithichnites*, bird-footsteps; *sauroidichnites*, saurian footsteps, &c. Footprints, supposed to be those of reptiles, have been discovered in rocks of Devonian age in Canada and in the coal-measures of our own country and Germany; and those of reptiles, birds, and undetermined animals occur abundantly in the New Red Sandstone of Britain, Germany, and North America. These creatures seem to have frequented muddy shores and estuaries, and to have left the impress of their feet on the yielding and half-dried mud, over which the next deposit of sediment spread and filled up the mould. On splitting many of these sediments (now converted into shales and sandstones) the mould and its cast are found in great perfection—so much so that not only the joints of the toes, but the very texture of the skin is apparent. Hildburghausen in Saxony, Corncockle Muir in Dumfriesshire, Stourton, Weston, and Taporley in Cheshire, Grimsell in Shropshire, and the valley of the Connecticut in North America, are the localities most celebrated for their fossil footprints—and this in strata of Permian or of Triassic age.

Ichnolite (Gr. *ichnos*, a footprint, and *lithos*, stone).—Any fossil footmark, or stone retaining the impression of the feet of extinct animals.

Ichnólogy or **Ichnolithology** (Gr. *ichnos*, a footprint, *lithos* and *logos*).—The science of fossil footprints; *e.g.*, the *Ichnology of Annandale* by Sir William Jardine; the *Ichnology of New England*, by Dr Hitchcock.

Ichthyocóprus or **Ichthyocóprolite** (Gr. *ichthys*, fish, *copros*, excrement, and *lithos*).—Literally, the fossil excrement of fishes. Coprolites of this nature occur in all the secondary formations; but in great profusion and of gigantic size in the shales of the lower coal-formation.

Ichthyodórulite (Gr. *ichthys*, fish; *doru*, spear; and *lithos*, stone).—The fossil fin-spines or defences of fishes, found abundantly in all the fossiliferous strata—those of the shark-like fishes (*Cestracionts*) of the lower coal-measures being often more than a foot in length, and strong in proportion. These spines are generally straight and tapering, but many of them are more or less recurved or falcate. The inserted portion is blunt and plain; the external defence enamelled and often highly sculptured—some being grooved transversely and spirally (*gyracanthus*), others striated or fluted longitudinally (*onchus*); some ornamented with points and tubercles (*cosmacanthus*), and others serrated or hooked on the posterior margin (*ctenacanthus*).

I'chthyoid (Gr. *ichthys*, fish, and *eidos*, likeness).—Fish-like; partaking

of the fish type, as the ichthyosaurus, which is partly ichthyoid and partly sauroid.

Ichthýolite (Gr. *ichthys*, fish, and *lithos*, stone).—A palæontological term for a fossil fish, or any portion of a fish, as a scale, tooth, spine, &c. The most celebrated deposits of fossil fishes in Europe are the bituminous schists of the lower Old Red of Orkney and Caithness; the yellow sandstones (upper Old Red) of Dura-Den, Fifeshire; the lower coal-measures of Burdiehouse, &c., near Edinburgh; the coal formation of Saarbruck in Lorraine; the Permian bituminous slate of Mansfield in Thuringia; the calcareous lithographic slate of Solenhofen (oolitic); the compact blue slaty shale of Glaris (cretaceous); and the Tertiary limestones of Monte Bolca, near Verona, the marlstones of Oeningen in Switzerland, and of Aix in Provence.

Ichthyólogy (Gr. *ichthys*, fish, and *logos*, discourse).—That branch of Zoology which treats of the structure, classification, habits, and history of fishes; *Ichthyological*, relating to the science of Ichthyology; *Ichthyologist*, one who studies, or is devoted to, the science of fishes.—See PISCES, and tabulations, "Animal Scheme."

Ichthyopátolítes (Gr. *ichthys*, fish; *patos*, footpath; and *lithos*, stone).—Fish-tracks, or the imprints of the pectoral fin-rays of certain fishes, which, like the gurnard and climbing perch, can move on solid surfaces by means of these organs. Under this name Dr Buckland described (*Proceedings of Geol. Soc.*, vol. iv.) certain problematical markings observed on a flagstone from the coal-measures of Flintshire. It consists of curvilineal scratches or imprints, disposed symmetrically at regular intervals on each side a smooth level space, about two inches wide, which may correspond to the body of a fish, the pectoral fins of which, Dr Buckland suggests, were the instruments that formed the markings in question.

Ichthyóphagous (Gr. *ichthys*, fish, and *phagein*, to eat).—Fish-eating; feeding on fish.

Ichthyophthálmite (Gr. *ichthys*, and *ophthalmos*, the eye).—Fish-eye-stone; a variety of *apophyllite* or pyramidal zeolite, characterised by its peculiar pearly lustre.

Ichthyosárcolite (Gr. *ichthys*, fish; *sarcos*, flesh; and *lithos*, stone).—Literally, "fish-flesh-stone;" a term at one time applied to certain thick, heavy, tapering organisms from the Chalk, in allusion to their flaky or foliaceous structure. They are now known as *Radiolites* and *Sphærulites*, peculiar bivalve shells belonging to the family HIPPURITIDÆ, which see.

Ichthyosáurus (Gr. *ichthys*, fish, and *saurus*, lizard).—Literally "fish-lizard;" a well-known genus of the extinct *Enaliosaurs* or marine saurians, and so called from its combining the characters of saurian reptiles and of fishes with some of the peculiarities of the whales. The ichthyosaurs were in fact the "reptile-whales" of their period—a period extending from the deposition of the middle Trias or muschelkalk till near the close of the Chalk formation. The peculiarities of their structure have been thus described:—Their vertebræ resemble those of fishes in being bi-concave, or concave at both ends; but the superior arches remain permanently detached as in reptiles. The cranium resembles that of the crocodiles, but is characterised by a peculiarly large eye-orbit furnished with a circular series of bony sclerotic plates—a structure not occurring in fishes, but observable in the eyes of turtles, lizards, and many birds. The nostrils are situated, not, as in the crocodile, near the extremity of the snout, but close to the anterior part of the orbit, approaching in this respect some of the recent lizards.

The teeth, which are extremely numerous (amounting in some species to nearly 200), resemble in structure those of the crocodiles—being conical, longitudinally striated, and expanded at the base; but are implanted, as in some of the lizards, in a deep continuous groove, and not in distinct sockets. The locomotive extremities are similar in construction to the paddles of the whale; but they are four instead of two in number, and the front paddles are connected by a broad coracoid, a complete clavicle, and a supplementary coracoid bone to a strong sternum; the flattened phalangeal bones supporting the fin are polygonal, and are relatively shorter and more numerous than in the whale. The hind-paddles are smaller than the fore, and are attached to a pelvis similar to that of the crocodile. Small supplemental bones are wedged into the lower part of the joint of the atlas and occiput, and a few of the succeeding vertebral joints; and the tail often presents a fracture or abrupt bend about a third of its length from the extremity, as if it had been swayed aside during decomposition by the weight of a large vertical tail-fin. From the form and position of masses of crushed and apparently half-digested fish-bones and scales in the abdominal cavity of certain specimens, it is concluded that they preyed on fish; and from the shape of their *coprolites* (fossil excrements) it is obvious that their intestinal canals were furnished with spiral valves as in the sharks. In one or two instances, very small, and to all appearance *fœtal* specimens, have been found within the pelvic cavities of large skeletons, and from this circumstance it has been inferred that the ichthyosaurs, like the whales, were viviparous. As already mentioned, the great era of ichthyosaur development was from the middle Trias to the Chalk inclusive—the Lias formation being the chief repository of their remains in England. In this deposit specimens of all ages and of all sizes have been found—from the fœtus of a few inches to the adult more than thirty feet in length; and of these the finest are now preserved in the British Museum, and the museum at York.

I'docrase (Gr. *eidos*, form, and *krasis*, mixture).—Known also as Vesuvian and Pyramidal Garnet, and differs from common garnet chiefly in form. Idocrase (so termed from the *mixed forms* of other minerals which it presents) was originally found in the ejected calcareous blocks on Vesuvius, in druses with garnet, augite, &c.; but it also occurs in subordinate beds in the primitive rocks with calc-spar, garnet, epidote, chlorite, and other silicates. It forms an indifferent ornamental stone, the brown being named *hyacinth*, and sold at Naples under the name of "Gemmes de Vesuve;" the green, *chrysolite*. Several local varieties are also distinguished, as *Wiluite*, from Wiloui in Siberia, an obscure green; *Cyprine*, a blue variety containing copper, from Norway; and *Egrane*, a liver-brown sort from Eger in Bohemia.

I'drialine or **Idrialite**.—One of the mineral resins, so named from its being found at Idria in Carniola, in thin layers among the slates containing the mercury ores. It occurs in soft, brownish-black, flaky masses, having a resinous lustre and greasy feel; and from these masses, which consist of idrialine and cinnabar, with a little silica, alumina, pyrites, and lime, the pure pearly *idrialine* may be extracted by oil of turpentine.

I'gneous (Lat. *ignis*, fire).—Applied to all agencies, operations, and results which seem connected with, or to have arisen from, subterranean heat, as "igneous rocks," "igneous fusion," &c. The *igneous rocks*, properly so called, comprehend the Volcanic, Trappean, and Granitic series, all of

which are evidently the products of fusion either in the interior or at the surface of the crust. The term *igneous* is thus synonymous with *unstratified, Plutonic, pyrogenous,* and others in use by geologists.

Ignígenous (Lat. *ignis,* and Gr. *ginomai,* I am formed).—Fire-formed; used as synonymous with igneous, though, properly speaking, *igneous* refers to the operation or agency, and *ignigenous* to the result.

Iguánodon.—One of the Dinosaurs; a colossal lizard-like reptile found in the Wealden strata, and so called from the resemblance of its teeth to those of the existing iguana of South America. "According to the present state of our knowledge," says Dr Mantell in 1851, "it is not at all improbable that the largest Iguanodons may have attained a length of from sixty to seventy feet. Although some important points in the osteology of the Iguanodon are still unknown, we may safely conclude that the stupendous reptile equalled in bulk the largest herbivorous mammalia, and was as massive in proportions. Its limbs must have been of proportionate size and strength to sustain, and move, so enormous a carcass; the hinder extremities in all probability resembled the unwieldy contour of the hippopotamus or rhinoceros, and were supported by strong short feet, protected by broad unequal phalanges: the fore-feet appear to have been less bulky, and adapted for seizing and pulling down the foliage and branches of trees; the jaws and teeth demonstrate its power of mastication, and the character of its food; while the remains of the coniferous trees, arborescent ferns, and cycadeous plants which are found imbedded with its remains, attest the nature of the Flora adapted for its sustenance." The Iguanodon occupies a chief place among Mr Hawkins' palæontological restorations in the grounds of the Crystal Palace.

I'lmenite.—Known also as *titanitic iron;* an ore of iron occurring in various formations, as in the miascite of the Ilmen mountains: hence the name. According to H. Rose and Scheerer, it is a combination of peroxide of iron and the blue oxide of titanium in various proportions—the specific gravity increasing with the amount of iron.

Imbricated (Lat. *imbrex,* a gutter-tile).—Overlapping, or laid over each other like the tiles or slates of a roof; applied to the scales of fishes, the scutes of reptiles, the persistent leaflets or petioles of certain trees, &c.

Impálpable (Lat.)—Not perceptible to the touch; applied to dust, powdery substances, mud, and the like, in which no gritty particles can be felt by the touch. Reduced to the minutest particles or ultimate stage of subdivision.

Impérforate, Imperforated (Lat. *im,* not; *per,* through; and *foro,* I bore).—Not perforate; having no opening or passage of communication; not pierced. Applied in various branches of Natural Science.

Impérmeable (Lat. *im,* not; *per,* through; and *meo,* I pass).—Not admitting the passage of water; applied to strata or other masses which, like clay, obstruct the natural passage or percolation of subterraneous waters.

Impérvious (Lat. *im,* not; *per,* through; and *via,* a way).—Impenetrable; impassable; affording no way or passage. Hence we speak of certain strata being "impervious to water," and so on.

Impónderables (Lat. *in,* priv., and *pondus,* weight).—A term applied in Physical Science to agents which, like heat, light, and electricity, are destitute of weight, and only known by their effects on other bodies.

Incandéscence; Incandescent (Lat. *candesco,* to begin to grow white).

—A glowing *white* heat; having a *white* heat, or greater degree of heat than red heat.

Incineration (Lat. *in*, and *cinis, cineris*, a cinder).—The act of burning or reducing to ashes; distinct from *calcination*, which see.

Incísors (Lat. *in*, and *cædo*, I cut).—The cutting teeth or front teeth of mammals, as distinguished from the grinding or *molar* teeth.—See TEETH.

Incombústible (Lat.)—Applied to substances that will not burn, or which cannot be consumed by the action of fire.

Incrustation (Lat. *in*, and *crusta*, a crust or rind).—A crust or coating formed on the surface of any substance. Waters containing lime, clay, and other mineral impurities, leave an "incrustation" on the inside of the vessels in which they are boiled; calcareous waters "incrust" the rocky surfaces over which they flow with a coating of calc-tuff.

I'ndianite.—A reddish-grey variety of Anorthite (one of the felspars) found in the Carnatic, where it forms the matrix of the corundum. It consists of 42 silica, 34 alumina, and 15 lime, with iron, potash, and soda.

Indícollite or **Indigolite.**—A variety of tourmaline found at Utoe in Sweden, and so named from its deep-blue indigo colour.

Indígenous (Lat. *in*, and *geno*, I produce).—Born or produced in a particular country; native to a country. Applied to plants and animals, but more especially to the former, in contradistinction to *exotic;* that is, those not native to the country in which they are cultivated.

Indurated (Lat. *durus*, hard).—Restricted in Geology to rocks that have been hardened by the action of heat, and in this sense distinct from "hard" or "compact."

Indúsial Limestone.—"There is another remarkable form of fresh-water limestone in Auvergne," says Lyell, "called 'indusial,' from the cases or *indusiæ* of caddis-worms (the larvæ of Phryganea), great heaps of which have been incrusted, as they lay, by carbonate of lime, and formed into a hard travertin. The rock is sometimes purely calcareous, but there is occasionally an intermixture of siliceous matter. Several beds of it are frequently seen, either in continuous masses or in concretionary nodules, one upon another, with layers of marl interposed." These limestones point, of course, to a time (Eocene) when certain districts of Auvergne were covered by fresh-water lakes, in which the larvæ of the Phryganea swarmed as they do now in the stagnant pools and ditches of England.

Indúsium (Lat.)—Literally, a garment or covering. In Natural Science applied variously; *e.g.*, the *indusium* or case of the caddis-worm; the brown dried epidermis which covers the fertile sori or reproductive specks on the fronds of ferns, &c.

Inflammable Air.—An old chemical term for hydrogen gas; so named on account of its highly inflammable nature.

Infusória.—Minute animal organisms or animalcules; so called from their being readily obtained (for microscopic investigation) in infusions of vegetable matter which have been freely exposed to the air. In modern zoology they constitute the highest class of the Protozoa, and have been arranged into numerous families which are yet far from being well defined —partly from the minuteness of the organisms, and partly from the liability to mistake for *infusoria* the embryonic germs of other creatures, and, above all, the active germs or spores of the lower forms of vegetation. They are generally unicellular animals; are furnished with a mouth and rudi-

mentary digestive apparatus; and their bodies, for the most part, consist of three distinct layers, the outer of which is usually furnished with cilia or vibratory appendages. They inhabit lakes, pools, and ditches; many are found in the ocean; and some are indifferent alike to salt or fresh water. Mistaking other microscopic forms for *infusoria,* it has been customary to speak of their calcareous and siliceous shields as entering largely into the composition of many recent muds and marls, as well as into that of several of the more ancient stratified deposits; but according to the latest zoological authorities, there are no fossil *Infusoria,* the organisms usually designated by this name being either *Foraminifera, Polycystina,* or *Diatomaceæ.*—See PROTOZOA.

Inocéramus (Gr. *is, inos,* fibre, and *keramos,* vessel-shell).—A genus of fossil bivalves belonging to the *Aviculidæ* (wing-shells or pearl-oysters), and so named from the fibrous structure of their shells. The valves are unequal, ventricose radiately or concentrically furrowed, umbones prominent; hinge-line straight, elongated, and pitted with numerous close-set cartilage grooves. The species, which range from the Silurian to the Chalk inclusive, vary in size from one inch to three or four feet in diameter. The shell, in consequence of the vertical arrangement of the fibres, readily breaks to pieces, and large flat fragments are found in the Chalk, often perforated, as in recent oysters, by the Cliona (*clionites*). The French restrict the name *Inoceramus* to the beaked and laminated species of the Gault; and arrange the Chalk Inocerami under the term *Catillus.*

Inorgánic (Lat. *in,* not, and *organum,* a member or instrument).—Not produced by vital action. Applied to mineral substances which are the results of chemical or mechanical aggregation, in contradistinction to vegetable and animal substances, which are produced by vital action, or through the instrumentality of vital organs.—See ORGANIC.

Insécta (Lat. *insectum,* divided into segments).—An extensive class of articulated animals, and so called from the segmented aspect of their bodies. In Cuvier's arrangement it includes the following orders: *Myriapoda* (*e.g.,* centipede); *Thysanoura* (springtail); *Parasita* (louse); *Suctoria* (flea); *Coleoptera* (beetle); *Orthoptera* (earwig); *Hemiptera* (bug); *Neuroptera* (ant-lion); *Hymenoptera* (wasp); *Lepidoptera* (butterfly); *Rhipiptera* (stylops); and *Diptera* (fly). The insects are well known by their segmented bodies, three pairs of feet, one pair of antennæ, compound eyes, generally undergo metamorphosis and acquire wings, and are oviparous, with the sexes distinct. Remains of some of the orders are found as early as the Carboniferous formation, and they abound in the Oolite and later deposits.—See the respective Orders.

Insectívora (Lat. *insecta,* insects, and *voro,* I devour).—An interesting group of the Carnivorous mammalia, characterised by their molar teeth being studded with sharp points, which enables them to feed on insects. The group comprises the mole, hedgehog, shrew, bat, &c. The teeth and jaw-bones of animals apparently insectivorous (*spalacotherium, microlestes,* &c.) have been found as low as the Oolite and Upper Trias.

In sítu (Lat.)—Literally "in its natural position or place." A rock or fossil is said to be "*in situ*" when it is found in the situation or place in which it was originally formed or deposited; but it is *not in situ* when removed or drifted to another position or locality.

Inspissáted (Lat. *in,* and *spissatus,* thickened).—Thickened; made thick

by evaporation, whether natural or artificial; as opium, which is the *inspissated juice* of the poppy.

Interambulácra, Interambulacral (Lat. *ambulare,* to walk).—The imperforate plates which lie between (*inter*) the perforate plates or *ambulacra* in the shells or crusts of the sea-urchin and cidaris.

Intércalated, Intercalátion (Lat.)—Interposed, something placed between; the act of placing between. Subordinate beds of a different nature occurring between the main beds of a series are said to be *intercalated;* the occurrence of such beds or of intervals of deposition are said to be *intercalations.* Of frequent use in Geology.

Intercólline (Lat. *inter,* between, and *collis,* a hill).—A term proposed by Sir Charles Lyell to designate those valley-like spaces or hollows that occur in volcanic regions between the *cols* or crateriform hillocks of accumulation, and which are not formed by aqueous erosion, nor by subsidence, nor by anticlinal or synclinal flexures, but simply by the building up on two or more sides of erupted materials. Such *intercolline* spaces abound in all volcanic regions of sub-aërial origin.

Intermittent, Intermitting (Lat. *inter,* between, and *mitto,* I send).—Ceasing for a time and then returning; ceasing and acting by turns. *Intermitting Springs* are those which, having flowed for a certain time, stop altogether, and after a time begin to run again, and then stop; and so on alternately, the flowings and intermissions generally succeeding each other at pretty regular intervals. Such phenomena are easily explicable on the supposition of caverns and subterranean areas being fed by small chinks, and discharged by larger fissures acting on the principle of the siphon—the larger outlet, acting more rapidly than the united chinks, when once set a-running, flows till the cavern is emptied, and then ceases till the water again accumulates to its siphon-level.

Interstrátified.—Occurring in the midst of, or along with, other strata. In this sense coal may be said to be interstratified with sandstones, shales, fire-clays, and limestones; but the term is generally restricted to those bed-like masses or overflows of igneous rock (lava, basalt, and greenstone) which occur imbedded with true stratified or sedimentary rocks—the igneous overflow having spread over the bottom of the sea of deposit, and been subsequently overlaid by other strata.

Intertrópical (Lat. *inter,* between, and *tropical*).—Situated between the tropics; applied also to plants and animals whose habitats lie between the tropics, or in the torrid zone.

Intumésce (Lat. *intumesco,* to begin to swell).—To swell or bubble up as zeolite and other kindred minerals do under the action of the blowpipe.

Invertebráta.—One of the two great divisions of the animal kingdom; *animals without vertebræ or back-bones,* including the Mollusca, Articulata, Radiata, and Protozoa.—See tabulations, "Animal Scheme."

Iodine (Gr. *ion,* violet, and *eidos,* likeness; violet-coloured).—One of the chemical elements, occurring as a non-metallic, crystallised, and solid substance. It is obtained from marine plants, from sea-water, and from certain mineral springs, and is of some repute in *materia medica.* It becomes volatile at a low temperature, and passes off in a beautiful violet-coloured vapour; hence the name.

Iódite or Iódic Silver.—An ore of silver, consisting of iodine and silver, and occurring in thin flexible foliæ or plates of a pearl-grey or yellowish-

grey colour. It is found in the mining districts of Mexico and South America, and recently in the south of Spain.

Iólite (Gr. *ion*, a violet, and *lithos*, stone).—One of the Gems, known also as *Dichroite, Cordierite,* and *Prismatic quartz.* It occurs in granitic and primitive rocks, associated with quartz, garnet, and iron and copper pyrites, and derives its name from its colour, which ranges from violet to dark-blue. It has many allied and doubtful species; and according to Stronmeyer consists of 48.35 silica, 31.71 alumina, 10.16 magnesia, 8.32 iron protoxide, with traces of manganese.

Iridéscent (Gr. *iris*, the rainbow).—The property of producing a play of colours resembling those of the rainbow; possessed both by animal and mineral substances. **Iridescence**, shining with the colours of the rainbow; a property depending generally on internal structure, or the arrangement of internal surfaces which refract the light; but sometimes also arising from mere external *tarnish*, occasioned by partial decomposition, or the action of acids.

Irídium (Gr. *iris*, the rainbow).—The most infusible of the known metals, and used chiefly in porcelain painting to produce black and grey colours. It occurs in nature in combination with platina, palladium, osmium, and copper; and derives its name from the variety of hues which the mixture displays while dissolving in hydro-chloric acid. It was discovered by Dr Wollaston; is of a grey colour, brittle, very infusible, and has a specific gravity of about 18.6.

Irish Deer, Irish Elk.—Remains of the Irish gigantic deer (*cervus megaceros*, or deer with great antlers) are found in the peat-bogs, marls, gravels, and other superficial deposits of Europe; but particularly in the shell-marls and peat-bogs (the sites of ancient lakes) in Ireland: hence the name. It is usually, but erroneously, termed *Elk* – the creature being a true deer, though far exceeding in magnitude any living species. Skeletons have been found ten feet high from the ground to the point of the antlers, which are palmated, and often measure from ten to fourteen feet from tip to tip. Chronologically, the Irish deer seems to have been antecedent to man in Europe, though some of their species appear also to have been cotemporary with him, and to have been extirpated by the earliest hunter tribes that took possession of its plains and forests.—See Denny in *Proceedings of York Geolog. Soc.* for 1855.

Iron (Gr. *sidēros;* Lat. *ferrum;* Fr. *fer;* Ger. *eisen*).—One of the best-known, and, economically speaking, by far the most important of the metals. Though readily tarnished, rusted, or oxidised by exposure to air and moisture, it has in the fresh fracture a peculiar grey colour, known as "iron-grey," or "steel-grey," and, when polished, possesses much lustre. It is not very malleable, but extremely ductile and very tenacious. At common temperatures it is hard and unyielding, but at a red heat it is soft and pliable, and at a high red-heat two pieces may be inseparably united by hammering, or *welded*, as it is technically termed, into one mass. It is very difficult of fusion, requiring for that purpose the highest heat of the blast-furnace. In this state it can be run into moulds, and is then known as *cast-iron*, which is hard, brittle, and of a granular texture. Subjected to repeated heating and hammering (*puddled*, as it is termed), it becomes less fusible, assumes a fibrous texture, gets tough and malleable, and is then known as *forged* or *wrought-iron*. The average specific gravity of cast iron is 7.27, that of forged 7.78. Iron is attracted by the

magnet, and is itself susceptible of being rendered magnetic—a property possessed by no other metal except nickel. It is capable of forming alloys with several of the metals, though in this state little used; and with a small proportion of combined carbon it forms *steel,* a substance of incalculable importance to all the industrial arts and manufactures.

Unlike many of the other metals, iron is rarely found in a *native* state; and this in scarcely appreciable quantities, in stones and masses of meteoric origin. This *meteoric iron,* as it has been termed, contains nickel, along with cobalt and other metals; and what is known as *telluric iron* occurs in minute grains and scales in other mineral veins, and contains carbon, graphite, or occasionally some other metal, but not nickel. On the whole, *native iron* is a very rare and doubtful substance; and all the iron of commerce is derived from *ores* (oxides, carbonates, &c.) either pure or in combination with various earthy ingredients, forming *ironstones.* These ores and ironstones occur in rocks of all ages—the ores chiefly in veins and abnormal masses among metamorphic schists, the ironstones in bands and layers among the strata of the Carboniferous, Oolitic, and other later formations. The ores are usually regarded as belonging to two families—1*st,* the SPARRY IRON ORES, the most important member of which is *siderite, spathose iron,* or *carbonate of iron,* and which includes the *clay ironstones,* or the "clay-bands" and "black-bands" of the coal and other formations; and 2*d,* the OXIDISED IRON ORES, embracing such well-known species as *magnetite* or magnetic iron, *hematite* or specular iron, *limonite* or brown iron-ore, and the like. In nature, iron enters largely into the composition of many rocks and rocky compounds; and also forms many chemical combinations, as oxides, carbonates, chromates, phosphates, sulphurets, and sulphates. Its presence in water is readily detected by the tincture of galls, or by the ferro-cyanate of potash—the former turning weak solutions purple or dark-blue, and forming a black precipitate where the metal is more abundant—the latter producing Prussian blue under similar circumstances.—See tabulations, "Mineral Scheme."

Iron Pyrítes.—Bi-sulphurets of iron, of which Mineralogists distinguish three species,—1. *Pyrite,* yellow sulphuret of iron, or hexahedral iron pyrites; 2. *Marcasite,* white sulphuret of iron, or prismatic iron pyrites; and, 3. *Pyrrhotine,* magnetic iron pyrites, or rhombohedral iron pyrites. —See these specific terms and PYRITES.

Iron Sinter.—Known also as *pitchy iron ore* or *pittacite;* a recent product, arising apparently from the decomposition of mispickel, and occurring in old mines in reniform or stalactitic brittle crusts of a dark-brown colour and vitreous lustre. It consists of 35 iron protoxide, 26 arsenic acid, 9 sulphuric acid, and 30 water.

Ironstone.—The familiar as well as technical term for the ores of iron, whether occurring in sparry veins like *hematite, magnetite,* and *siderite,* or in regular stratified layers like the *clay-bands* and *black-bands* of the coal-measures. Industrially, it is usual to apply the term to any ore, rock, or matrix that yields an available per-centage of iron; though in Geology it were advisable to restrict it to ferriferous rocks of truly stratified or sedimentary origin.—See IRON.

Iso— (Gr. *isos,* equal).—A prefix denoting *equality* or *similarity,* as *isochronous,* occurring in equal times; *iso-metrical,* having similar dimensions.

Isocárdia (Gr. *isos,* like, *cardia,* the heart).—The heart-cockle; a genus of bivalve shells belonging to the family *Cyprinidæ,* and characterised by

their large, ventricose, or sub-globular shells; the umbones of which are distant and curved inwards, giving to the shell its peculiar heart-like shape. The living species are few, littoral, and burrowing in sand; the fossil exceed seventy species, and are found in the Trias upwards.

Isocheímal or **Isochimenal** (Gr. *isos,* and *cheima,* winter).—Having the same winter temperature; hence *isocheimal lines* are those drawn through such places as have the same mean winter temperature.

Isóchronous (Gr. *isos,* and *chronos,* time).—Occurring in equal times, or at intervals of the same duration; as the strokes of the pulse, the swing of pendulums of equal lengths, and the like.

Isodynámic (Gr. *isos,* and *dynamis,* power).—Having the same power or force. Equal in power, and capable of producing the same results.

Isogeothérmal (Gr. *isos, gê,* the earth, and *thermê,* heat).—Applied to lines or divisions in the earth's crust which have the same mean annual temperature; and employed as being more definite than *isothermal,* inasmuch as it refers solely to the land, whereas isothermal applies equally to air, land, and water.

Isómerism, Isoméric (Gr. *isos,* and *meros,* part).—Applied in Chemistry to express the relation existing between bodies which agree in composition but differ in properties. Isomeric bodies generally agree in the relative proportion of their constituents only, and differ either in the aggregate number of their atoms, or in the manner in which these atoms are arranged.

Isomórphism (Gr. *isos,* and *morphê,* form).—A term employed in Chemistry and Mineralogy to designate the capability shown by two or more simple or compound substances to crystallise in one and the same form; or often in forms which, though not identical, yet approximate very closely, when it has been named *homœomorphism.* This similarity of form is generally combined with a similarity in other physical properties. The law of isomorphism, as expressed by Mitscherlich, the discoverer of the doctrine, is this:—The same number of atoms combined in the same way produce the same crystalline form; and crystalline form is independent of the chemical nature of the atoms, and determined only by their number and relative position.

Isópoda (Gr. *isos,* and *pous, podos,* a foot).—An order of Crustaceans, which, like the *oniscus* or woodlouse, have the trunk divided into seven rings or segments, each segment sustaining a pair of similar unguiculate feet; hence the name. In the *Isopods,* the head or cephalic segment is distinct from the trunk; is furnished with antennæ, and with sessile eyes, which are either composed of clusters of ocelli or compound. Remains of the order (*Archæoniscus*) have been found in the Purbeck beds of the Oolite.

I'sopyre (Gr. *isos,* and *pyr,* fire).—An amorphous, brittle, greyish-black mineral, of a vitreous lustre and slightly magnetic. It occurs in the granites of Cornwall, and in the trap-rocks near Edinburgh; and consists, according to Turner, of 47.09 silica, 13.91 alumina, 15.43 lime, 20.07 iron peroxide, and 1.94 copper oxide. The name refers to the slight change produced on its aspect by fusion.

Isótheral (Gr. *isos,* and *theros,* summer).—Having the same summer temperature; *isotheral lines,* lines connecting all those places on the surface of the globe which have the same mean summer temperature.

Isothérmal (Gr. *isos,* and *thermê,* heat).—Having the same temperature; of equal temperature. In Physical Geography, *Isothermal lines* are lines

connecting all those places on the surface of the globe which have the same mean temperature; and as temperature is governed by relative distribution of land and water, by altitude and other conditions, places on the same parallels of latitude are often on very different isothermal lines.

I'ttnerite (after *Ittner*).—A rather rare mineral occurring in granular aggregates in trap and volcanic rocks, and consisting of silica, alumina, and soda, with lime, sulphuric acid, and water. Allied to *sodalite, nosean,* and *haüyne.*

Ivory, Fossil.—The terms "Fossil Ivory" and "Siberian Ivory" are frequently given to the teeth and tusks of the mammoth, which at one time were, and are still, collected in considerable abundance from the plains, shores, and low islands of Siberia. In 1844, it is said that about 16,000 lb. weight of this ivory was obtained from these regions, and of a quality, for the most part, superior to the recent ivory of Africa.—See MAMMOTH.

I'xolyte (Gr. *ixos,* birdlime, and *lithos,* stone).—One of the mineral resins of a hyacinth-red colour, and found in amorphous lumps in the tertiary lignites of Austria. It becomes soft at 169°, and is still viscid at 212° Fahr.; hence its name.

J

Jade.—A hard, tough, siliceo-magnesian rock of a dark leek-green colour, smooth surface, and somewhat soapy feel. It occurs in compact masses, has a coarse, splintery fracture, and is found in various parts of Europe, America, Egypt, China, and New Zealand. It consists chiefly of silica, magnesia, and lime, with a small per-centage of iron and alumina, and from its composition is supposed to be a peculiar condition of augite and hornblende. Being tenacious and susceptible of a fine polish, it is worked into amulets, ringstones, chains, and other ornaments; in China it is valued for its supposed medicinal properties in nephritic or kidney diseases, hence the synonym *nephrite;* and in New Zealand a variety, called by the natives "Poenamu," is fashioned into axes, hangers, idols, &c.: hence also the occasional term *axe-stone.*

Jagged.—Irregularly cut or notched; denticulated or toothed like a saw. Applied to the sharp irregular edges and surfaces of minerals and rock-masses.

Jamb.—A miner's term for any thick mass of rock which prevents them pursuing the lode or vein.

Jamesonite (after Professor Jameson).—An ore consisting principally of the sulphurets of lead and antimony; or, according to analysis, of 43.44 lead, 35.47 antimony, 17.20 sulphur, with traces of copper, zinc, and iron.

Jargon or **Jargon of Diamond.**—A lapidary's term for a variety of zircon, colourless specimens of which are often sold for diamonds.—See ZIRCON.

Jasper.—A somewhat loosely-applied term for many siliceous compounds. When quartz is combined with a small proportion of alumina and iron, it

loses its transparency and becomes *jasper,* which is consequently tougher or less easily broken. "Jasper," says Nicol, "is coloured red by the peroxide, yellow or brown by the hydrate of iron, but also exhibits many other colours, as green, grey, white, and black, in some kinds alone, in others in spots, veins, and bands—the latter the ribbon or Egyptian jasper." It is found abundantly, in veins and bands, in rocks of all ages; and some varieties, as the *porcelain jasper,* are evidently beds of slaty shale, altered by the action of heat.

Jaspídeous, Jaspidean.—Resembling jasper; of the nature of, or containing jasper.

Jéffersonite (after Jefferson).—A variety of augite from Sparta in New Jersey, of a dark olive or black colour, and resinous or semi-metallic lustre.

Jet (*jayet, gagites,* from Gaga, a river in Asia Minor).—This well-known substance is rather a species of amber than coal, and is usually known in Prussia as "black-amber." It occurs in nodules and lumps, in lignitic strata; is electric when rubbed; is more resinous in lustre than the finest cannel coal, and is also specifically lighter. Though evidently of vegetable origin, it seldom reveals to the naked eye the woody-texture like lignite, but is uniform like asphalt—its intense velvety-black well adapting it for mourning ornaments, as earrings, brooches, bracelets, buttons, and the like. It is found in great purity and abundance in the cliffs of alum-shale on the Yorkshire coast; hence the "jet manufactories" of Whitby and Scarborough.

Jigging.—A miner's term for a method of dressing the smaller ores of copper, lead, &c., by the aid of a wire sieve suspended and shaken in a vat of water, so that the smallest particles pass through the sieve, and the larger are "sorted"—that is, the lighter and more earthy remain at the top, and the heavier and more metallic settle below.

Joints.—The fissures or rents which divide rock-masses into blocks more or less regular are properly so termed. They have been defined as "natural fissures, traversing rocks in straight and well-determined lines, and forming planes of separation which are often slightly open, and which, as they do not merely pass through strata, but through various semi-crystalline aggregations within the stratified mass, were evidently formed since the original accumulation of the strata." This jointed structure appears to have arisen in certain strata from shrinkage or contraction of the deposit while in the process of solidifying; in many instances it is the result of mechanical upheaval and disturbance; while in others the lines of fissure have definite compass-bearings, are arranged in sets, and seem to obey some more general but as yet undetermined law. In basalt and other columnar structures the joints are usually regarded as the results of crystallisation on a large scale. Referring the direction of joints in stratified rocks to lines of upheaval, Professor Sedgwick calls those which run parallel to the strike "strike joints;" those parallel to the dip, "dip joints;" and all others he calls "diagonal joints."

Júlo-eido-coprolítes (Gr. *ioulos,* a catkin, and *eidos,* resemblance).—The name given to the coprolites or fossil excrement of some unknown animal, in allusion to their catkin-like form.

Jumper.—In Mining and Quarrying, a large iron borer steeled at each end and worked by the hand.

Juncítes (Lat. *juncus,* a rush).—Fossil stems and leaves apparently re-

lated to the *Juncaceæ* or Rush family, which are chiefly inhabitants of marshy tracts in the temperate and colder regions. Such striated, grooved, and tapering rush-like fragments of leaves occur from the Devonian formation upwards, but their true affinities are not yet determined.

Juniperítes (Lat. *juniperus*, the juniper tree).—The generic term for such fossil coniferæ as are evidently allied to the juniper. Several species occur in tertiary lignites, and are known by their short, obtuse, broad-based leaves, arranged in four opposite rows round irregularly-forking branches.

Jura Limestone.—A term applied by Continental geologists to the limestones of the Jura Mountains, as equivalent with the Oolite and Lias of English geologists. It is the *Jura-kalk* of German geologists.

Jurassic.—A synonym of the Oolitic system, from the characteristic occurrence of its strata in the Jura Mountains, between France and Switzerland. The Jura beds are composed of limestones of various qualities, sands, sandstones, and thin-bedded clays, and contain the same fossils as those found in the Oolite and Lias of England. Indeed, it is remarked by Sir C. Lyell, "that in the Jura (distant about 400 geographical miles) the analogy to the accepted English type, notwithstanding the thinness or occasional absence of the clays, is more perfect than in Yorkshire or Normandy." There is this difference, however, to be observed, that while the English beds are little altered or disturbed from their original sedimentary character, those of the Jura and the outer ranges of the Alps are often highly indurated and crystalline. Continental geologists are in the habit of dividing the Jurassic formation into three groups—viz., the "White (or Upper) Jura," "Brown (or Middle) Jura," and "Black (or Lower) Jura." — See Oolitic System and tabulations, "Geological Scheme."

K

Kampécaris (Gr. *kampê*, a grub or caterpillar, and *caris*, shrimp).—A small crustacean discovered by the Author in the grey flagstones (Lower Old Red) of Forfarshire, and so named from its appearance. From its imperfect preservation its true affinities cannot be well ascertained; that is, whether a small phyllopod, or the larval stage of some larger crustacean.

Kámpylite.—An arseniate of lead, occurring with other ores of the metal in hexagonal prisms of a fine orange-yellow, and containing in addition phosphate of lime and traces of chromate of lead.

Kaneelstein.—A variety of garnet ranging from hyacinth-red to orange-yellow, and known also as *Hessonite* and *Cinnamon-stone*.

Kangaroo.—Remains of this marsupial have been discovered in Australia (the region to which it is still restricted), in the Pleistocene deposits of Darling Downs, Melbourne, &c., and in fissures and caves in the limestone of Wellington Valley, imbedded in red ochreous loam, and often incrusted by stalagmitic concretions. One of the species discovered greatly exceeds in size the largest existing kangaroo.

Kaolin (Chinese).—The name given to the finest porcelain clays, arising for the most part from the decomposition of felspar in soft earthy granites. Kaolin occurs in beds and masses, more or less pure, and is generally prepared for use by repeated levigations. Its composition is variable; but 48 silica, 39 alumina, and 13 water, may be taken as an available average.

Kapnite.—A variety of calamine or carbonate of zinc, containing more than 15 per cent of iron protoxide.

Kárpholite (Gr. *karphos,* straw, and *lithos*).—One of the hornblende family, occurring in zeolitic, or fine radiating capillary crystals, of a straw-yellow; hence the name.

Karphosiderite (Gr. *karphos,* straw, and *sidēros,* iron).—A straw-coloured mineral occurring in kidney-shaped resinous-looking concretions, resembling iron-sinter; and consisting, according to Harkort, of hydrous phosphate of iron, with a little oxide of zinc.

Karstenite (after Karsten).—Hausmann's synonym for *anhydrite* or prismatic gypsum.

Kastor and **Pollux.**—Two minerals of the Felspar family, so named by Breithaupt from their always occurring together. They resemble quartz in their hardness, transparency, and vitreous lustre; and are the most siliceous of the crystalline silicates.

Keene's Cement.—A calcareous cement or plaster now much used in the interior of houses, from its taking a fine polish. "If," says Ansted, "instead of being used with water, plaster-of-Paris in fine powder is thrown into a vessel containing a saturated solution of alum, and after soaking for some time is taken out, rebaked, once more reduced to powder, and then moistened with a solution of alum instead of pure water before use, you have *Keene's Cement.*"

Keil.—The same as reddle (*rœthel*) or red-clay. An argillaceous peroxide of iron, of a fine deep red, and used for marking.

Kelloway-Rock.—A calcareous or rather calcareo-arenaceous member of the middle Oolite from three to five feet thick, abounding in fossil shells (often entirely made up of them), and so called from its being well developed at Kelloway-bridge, Wiltshire.—See Oolitic System.

Kelp.—The common term for the *crude soda* obtained from the ashes of various *fuci,* and other sea-weeds. It was at one time extensively prepared along the northern coasts of Scotland and Ireland, as well as on the coasts of Holland and France, and used in the preparation of soap, alum, bottle-glass, &c., but is now almost entirely superseded by the soda obtained from sea-salt.—See Barilla.

Kentish-Rag.—A provincial term for a member of the Lower Greensand, consisting of a highly fossiliferous grey cherty or arenaceous limestone, much used for building in Kent and Sussex.

Kent's Hole.—A celebrated ossiferous cavern situated in the Devonian limestone near Torquay, in Devonshire.—See Ossiferous Caverns.

Kerate (Gr. *keras,* a horn).—Chloride of silver; horn silver—so called from its horny aspect. Kerate is generally a recent formation, occurring in the upper part of veins, and on silver that has been buried in the earth, or long immersed in sea-water.

Keratophýtes (Gr. *keras,* horn, and *phyton,* a shoot).—An old zoological term for those polypes which have a horny axis like the sea-fans, in contradistinction to the *lithophytes* or true stony corals.

Kermes (*kermes*, the cochineal insect).—One of the ores of antimony, so called from its deep cherry-red colour. It consists, according to Rose, of 75.06 antimony, 4.78 oxygen, and 20.49 sulphur.

Keuper (Ger.)—Literally "copper;" an abbreviated term for the upper member of the Trias, which consists in Germany of variegated cupriferous marls and marl-slates, sandstones, gypsum, and carbonaceous slate-clay—making in all a thickness of from 800 to 1000 feet. The keuper is the equivalent of the saliferous and gypseous shales and sandstones of Cheshire.—See TRIASSIC SYSTEM.

Kibble.—In Mining, a bucket, usually of iron, in which ore is drawn to the surface.

Kidney-iron-ore.—A familiar term for those varieties of hæmatite which occur in reniform or kidney-shaped concretions.

Kieselguhr (Ger.)—Literally "flint-fermentation;" the German term for the bergmahl or mountain-meal of Lapland, which resembles a siliceous paste or yeast, and consists chiefly of the siliceous shields of diatomaceæ.

Killas.—A Cornish name for a coarse argillaceous schist, or clay-slate, in which many of the metalliferous veins in that county and Devonshire occur.

Killinite.—A greenish grey or yellowish mineral, belonging to the Felspar family, and supposed by some to be only a decomposed *spodumene*, with which it occurs in the granite at Killiney, near Dublin.

Kim-Coal.—A provincial term for a highly bituminous shale occurring in the oolitic beds at Kimmeridge. This shale has been locally used as an inferior coal, and attempts have been made to distill from it naphtha, paraffine, and other analogous products. Sir C. Lyell is inclined to believe that its bitumen is partly of vegetable and partly of animal origin.

Kimmeridge-Clay.—A member of the Upper Oolite, consisting of thick beds of bluish-grey slaty clay, and in great part of a bituminous shale, which sometimes forms an impure coal (*Kim-Coal*). The group is well developed at Kimmeridge in the isle of Purbeck, Dorsetshire; hence the name. It is also largely developed and highly fossiliferous near Hartwell, in the vale of Aylesbury, Buckinghamshire.

King-Crab.—Known also as the "horse-shoe crab," from the shape of its carapace or shield; the *Limulus* of systematic zoology, which see.

Kirkdale Cave.—A celebrated cavern occurring in the Coralline Oolite at Kirkdale, about twenty-five miles N.N.E. of York, and remarkable for the variety as well as abundance of bones found imbedded in the calcareous mud that overspreads its floor.—See OSSIFEROUS CAVERNS.

Kírwanite (after Kirwan the mineralogist).—A mineral nearly allied to prehnite, of a dark olive green, and occurring in spheroidal masses, with a radiating fibrous texture in basalt in the Mourne Mountains, Ireland.

Kívi-Kivi.—The native name for the *Apteryx*, or wingless bird of New Zealand, sub-fossil congeners of which have been found in the river-silts of that country.—See APTERYX.

Klaprothine (after Klaproth the chemist).—Same as Azurite, Prismatic Azure-spar, or *Lazulite*, which see.

Kleyn Spawen or **Limburg Beds.**—An important group of highly fossiliferous strata belonging to the upper Eocene or lower Miocene epoch. They consist of sands, clays, and marls of marine or fluvio-marine origin, and are the equivalents of the Hempstead beds in the Isle of Wight.

Knebellite.—A mineral of a grey, green, or reddish-brown colour, apparently a variety of olivine, and consisting of about equal parts of silica, iron protoxide, and manganese.

Knórria (after Knorr).—A genus of coal-measure plants, embracing those stems the leaves of which were densely arranged in spiral manner, and left *projecting* instead of depressed leaf-scars. They are usually ranked as *Lycopods*, but seem intermediate between them and the *Coniferæ*.—See HALONIA.

Koth.—A name given by the Spaniards to an earthy slimy substance ejected from the volcanoes of South America. It is of a blackish-brown colour; has an earthy texture; and is but slightly coherent. Known also as *Moya*.

Kóupholite (Gr. *kouphos*, light, and *lithos*).—A term used by Lametheric for *Prehnite*, which see.

Kryolite; more commonly **Cryolite**, which see.

Kulock or **Kaloch**, near Rabenstein in Franconia, on the bank of the Esbach, celebrated for its remarkable ossiferous cave.—See OSSIFEROUS CAVERNS.

Kúnkur.—A Hindoostanee term for a superficial accumulation, which in point of time seems to correspond pretty well with the Drift or Boulder Clay of Europe. "It is compact," says Ansted, "often nodular or tufaceous, and frequently small-concretionary; of light brown, reddish, or ash-grey colour; and rarely fossiliferous. In its composition it is chiefly calcareous, containing about 72 per cent of carbonate of lime, and 15 per cent of silica, with 18 per cent of alumina. It spreads over a very large proportion of India and the adjoining countries, being more especially abundant in the line of country running up from Guzerat to the north-east, towards Delhi. It is constantly observed, not only occupying the low ground, but reposing under the vegetable soil of the elevated plains and plateaux of Central India, and even on the summits of hills between 2000 and 3000 feet above the level of the sea."

Kupfer-Nickel (Ger.)—Copper-nickel, prismatic nickel pyrites, or *Nickeline*, which see. It consists of arsenic and nickel, with sulphur, traces of cobalt, iron, lead, &c., and is used as an ore of nickel, and in the manufacture of German silver.

Kupfer-Schiefer (Ger.)—Literally copper-slate; a dark bituminous-looking slaty marl-stone, associated with the Zechstein (mine-stone) of Germany, and richly impregnated with copper-pyrites, for which it is extensively worked. It is the equivalent of the magnesian marl-slates (Lower Permian) of Durham, &c., and abounds in finely-preserved fishes—palæoniscus, pygopterus, platysomus, &c.—peculiar to that formation.

Kyanite, same as *Cyanite*, which see.

Kyson Sands.—A bed of eocene sand, occurring at Kyson or Kingston, a few miles east of Woodbridge in Suffolk, and celebrated for its yielding the remains of the monkey tribe—*Macacus eocænus* of Owen.

L

Lábradorite.—Called also *opalescent felspar,* or *Labrador felspar,* from the locality where first found; a variety of disseminated felspar having a peculiar pearly and iridescent play of colours when the light falls on it in certain directions. Bonsdorff ascribes this property to an excess of silica; Haidinger affirms that the play of colours proceeds from certain regularly-defined points.

Labyrínthodon (Gr. *labyrinthos,* a place full of intricate passages, and *odous,* tooth).—A name given by Professor Owen to a batrachian reptile of the New Red Sandstone, in allusion to the labyrinthine structure exhibited by sections of its teeth. No complete skeleton of the labyrinthodon has yet been discovered, but it is supposed to be one and the same with the *Cheirotherium,* the hand-like impressions of whose feet are so frequent on the slabs of the new red sandstone formation. The Labyrinthodont saurians, described at different times under the names *Cheirotherium, Mastodonsaurus, Salamandroides,* and *Phytosaurus,* are all referred by Owen to the genus Labyrinthodon, and appear to range from the Devonian to the Triassic inclusive.

Lacértian, Lacertílian (Lat. *lacerta,* a lizard).—Belonging to or resembling the Lacertinidæ or Lizard family, a well-known group of Saurian reptiles, recent and fossil.

Lacústrine (Lat. *lacus,* a lake).—Of or belonging to a lake; as "lacustrine deposits," that is, deposits which have been accumulated in fresh-water areas, as lakes and marshes. They usually consist of mud, marl (fresh-water limestone), peat-moss, and the like, and contain the remains of aquatic plants and animals, mingled less or more with those of land species.—See LAKES.

Læmodípoda (Gr. *laimos,* the throat; *dis,* two; and *pous, podos,* foot).—A family of crustaceans, thus named because they have the anterior pair of feet placed under the head, as though at the throat—the first segment of the trunk, which carries these feet, being conjoined with that of the head; *e.g.,* the *cyamus* or whale-louse. In the Læmodipods the eyes are sessile; the posterior part of the body is little developed; they do not swim, but creep on marine plants and animals in search of food; and in most (says Van der Hoeven) the feet are wanting in those rings that carry gill-vesicles, and conversely the gill-vesicles are wanting on those rings that have feet.

Lágomys (Gr. *lagos,* hare, and *mus,* rat).—Literally, "hare-rat;" the *Pika* of Siberia; a small tailless rodent forming a link between the hare and the rat, and occurring only in the northern regions of Asia and America. Several species have been found fossil in the ossiferous caverns and breccia, as well as in the ancient lacustrine deposits of Europe.

Lagoon or **Lagúne** (Ital. *laguna*).—Generally applied, as in the Adriatic, to shallow salt-water lakes or sheets of water cut off (or nearly so) from the sea by intervening strips of beach or river-deposit; also to the waters enclosed by circular coral-reefs; as well as to the lake-like sheets that frequently occur in tidal and periodically inundated deltas.

Lake (Lat. *lacus*).—The general term for any inland body of water not connected with the ocean or any of its branches. Lakes occur in depressions of the earth's surface more or less below the level of the surrounding country, and, generally speaking, have a tendency to become shallower, both from the silt that is carried into them by their feeding streams, and from the gradual deepening of the river-channel which forms their natural drainage. This tendency being continued, they, in process of time, become silted up, drained, and converted into tracts of alluvial land; hence it may be laid down as a geological axiom that in all long-established continents and islands lakes are now shallower, smaller, and fewer than in former ages. In the Current as well as in the Tertiary epoch we have abundant evidence of such obliterations; the formations arising from lake silt (lacustrine deposits) being characterised by peculiarities lithological and palæontological which separate them in a marked manner from marine sediments. These peculiarities are, tranquillity of deposition, absence of littoral action, the remains of fresh-water plants and animals, with a greater admixture of terrestrial organisms; and with these as guides there is little difficulty in determining lacustrine from estuary or oceanic deposits. Existing lakes are usually divided into *four* kinds—viz., 1. Those that have neither outlet nor inlet—subterranean springs and rains supplying the water, and evaporation carrying off the excess. These are usually small mountain-lakes or *tarns*, and the craters of extinct volcanoes. 2. Those which have an outlet, but receive no running water, being fed by springs rising from their bottoms and rocky margins. Lakes of this class are also small and situated in mountainous regions. 3. Those which both receive and discharge streams of running water, and which form alike the most numerous and most extensive in both hemispheres. 4. Those which, like the Caspian, &c., receive streams of running water, but have no visible outlet —the balance of level being maintained by evaporation. Such lakes are more or less impregnated with saline matter; and their saltness must be on the increase.

Lámantin.—The manatus, manatee, or sea-cow; an herbivorous cetacean, inhabiting the mouths of tropical rivers in Africa and South America. Fossil species occur in the miocene and pliocene tertiaries of Europe.

Laméllar, Lamellated (Lat. *lamella*, diminutive of *lamina*, a little plate). —Composed of very thin plates or scales; foliated; in paper-like leaves, as talc, mica, the oyster-shell, &c.

Laméllibranchiáta (*lamella*, a little plate, and *branchiæ*, the gills).—Blainville's term for the *Conchifera*, a class of bivalve shell-fish which, like the oysters, scallops, mussels, and cockles, respire by membraneous or leaf-like gills attached to the mantle.—See *Conchifera*.

Lámina, plur. **Laminæ**.—The Latin term for any thin leaf-like plate, as of metal. Many stratified rocks split up into thin layers or *laminæ;* hence the terms *laminated*, *laminar*, &c.

Laminárian Zone (*laminaria*, the sea-tangle).—That zone or belt of marine life which commences at low-water mark, and extends to a depth from forty to ninety feet, and in British seas is characterised, as its name implies, by the broad waving sea-tangle and larger algæ, by star-fishes, the common echinus, by tubularia, modiola, and pullastra.—See ZONE.

Laminarítes (*laminaria*, the broad sea-tangle).—A term applied by Brongniart to the broad-leaved fossil algæ of the upper, secondary, and tertiary formations.

Laminated (Lat. *lamina*, a thin plate).—Applied to strata splitting up into thin layers, as certain flagstones and tilestones, which occasionally exhibit from twenty to thirty laminæ in the thickness of a single inch—each *lamina* being the result of an independent deposit in tranquil waters.

Lamination (Lat. *lamina*, a plate or layer).—Arrangement in layers. Lamination prevails less or more in all sedimentary deposits, and is, for the most part, parallel to the lines of bedding or stratification; *oblique lamination* or *false-bedding* occurs, however, in many coarse thick-bedded sandstones, and seems as if the material composing the stratum had been carried forward by currents into deep water, and laid mass after mass on the sloping edge of the advancing deposit.

Lamna (Gr., a plate of metal).—A genus of sharks whose thin, sharp, plate-like teeth occur abundantly in the Chalk and Tertiary formations. These teeth are rather flat, sharp-pointed, with smooth trenchant edges, and a small sharp denticle (or little tooth) on either side the base.

Lánceolate, Lanciform (Lat. *lancea*, a lance or spear).—Lance-shaped; narrow and tapering like the leaves of many plants; *e.g.* the common ribwort.

Landslip.—Any portion of land that has slidden down in consequence of some undermining or disturbing action. Landslips, as might be expected, are most frequent in districts subjected to earthquake disturbance, and there they sometimes take place on such a scale as materially to affect the surface configuration of the country. They also occur extensively in steep mountainous regions like the Alps and Himalayas, especially on the breaking up of the winter's frosts, when large masses of the cliffs and mountain-sides, losing their cohesion, are precipitated into the valleys and river-courses below, with all their burden of soil, shrubs, and trees. In our own country they are sometimes occasioned by the undermining action of the waves, and not unfrequently, after heavy rains, by the softening of subjacent clayey beds where the strata are considerably inclined. For examples see *Lyell's Principles.*

Lániary, Laniáriform (Lat. *lanio*, I cut or tear).—Applied to the canine or cutting teeth of the Carnivora, in reference to their function.

Lanthánium, Lánthanum (Gr. *lanthano*, I conceal).—A rare metal, discovered by Mossander, associated with didymium in the oxide of cerium, and so named from its properties being *concealed*, as it were, by those of *Cerium*, which see.

Láophis (Gr. *laas*, rock, and *ophis*, serpent).—A tertiary serpent, the detached vertebræ of which, according to Owen, indicate a length of ten or twelve feet, and present some affinities to those of the rattle-snake.

Lapídify, Lapidification (Lat. *lapis*, a stone, and *fio*, I become).—Conversion into stone; the process by which soft, loose, or incohering substances, organic or inorganic, are converted into stony matter.

Lapílli (Lat. *lapillus*, a little stone).—Applied to a peculiar variety of volcanic cinders, or small slaggy concretions.

Lapis (Lat.)—A general term for any kind of stone; as *lapis ollaris*, potstone; *lapis lazuli*, ultramarine; *lapis ætites*, eaglestone, &c.

Lapis Lázuli.—A well-known mineral of an ultramarine or fine azure-blue colour, of various intensity. It is generally found massive and disseminated; of a finely granular or compact texture; and so hard as to scratch glass. It varies considerably in composition, but on the whole may be said to consist of about 50 silica, 11 alumina, and 16 lime, with minor

proportions of sulphuric acid, iron peroxide, magnesia, and sulphur. The depth of its colour seems to depend on the amount of iron and sulphur. It is found chiefly in crystalline limestone, but occurs also in the granitic and crystalline rocks. The finest specimens are obtained from China and Central Asia. It is used as an ornamental stone when sufficiently large and pure; but chiefly in the preparation of the fine pigment called *ultramarine*, which see.

Láridæ (Lat. *larus*, the sea-gull).—The Gull family, which includes the gulls, terns, petrels, and other well-known marine *Natatores*, or swimming-birds. The bones of allied species have been discovered in Post-tertiary and Tertiary strata; *e.g.*, *halcyornis*, *pelagornis*, &c.

Larva (Lat., a mask).—Properly, an insect in its grub, caterpillar, or maggot state, before it has attained its winged or perfect condition. **Larval**, applied to the embryotic stage of crustacea and other animals which undergo metamorphoses in their development, as well as to the grubs of insects.

Lasionite.—A phosphate of alumina, better known as *Devonite*, and *Wavellite*, the latter of which see.

Láterite (Lat. *later*, a brick).—Literally "brick-stone;" a peculiar clayey deposit of middle tertiary age, found in India, and so named from being cut into bricks and used for building. "It varies much," says Ansted, "in colour and composition, but generally consists of a reddish-brown or brick-coloured cellular clay, more or less indurated, and used by the natives as bricks when cut square. It hardens greatly and permanently on exposure, and is well adapted for buildings and fortifications." Portions of the deposit, however, pass into hard, compact jaspideous rock on the one hand, or into loosely-aggregated grits and soft ochrey clays on the other.

Látrobite (after M. Latrobe).—A pink or rose-red mineral, allied to felspar, and occurring in indistinct crystals or massive, associated with felspar, mica, and calc-spar.

Láumonite (after M. Laumont).—One of the zeolites occurring in druses in the trap-rocks, and known also as *efflorescent zeolite*, because, when exposed to the air, it loses its lustre and transparency, and is decomposed.

Lava (Ital.)—The general term for all rock matter that flows in a molten state from volcanoes, and which, when cooled down, forms varieties of tufa, trachyte, trachytic greenstone, and basalt, according to the varying proportions of felspar, hornblende, augite, &c., which enter into the composition of the mass; and according to the slowness or rapidity with which it is cooled. The more rapid the process of cooling, the more compact the rock; and thus we have among Volcanic products, just as among the older igneous rocks, every variety of texture from that of a glassy basalt to a granular trachyte or *greystone*, and from that to a soft earthy tufa or light vesicular pumice. The rocks known as *obsidian*, *pumice*, *scoriæ*, &c., are therefore mere varieties of lava or volcanic rock-matter. Respecting the temperature, liquidity, rate of cooling, and other conditions of newly-ejected lava, we have no very certain data, nor is it likely that any two eruptions will exactly coincide in any of these particulars. This much, however, we know, that while some lavas are sufficiently hot to melt fragments of rocks thrown into their current, others are so little above the melting-point that they are covered with a stony crust almost immediately on their exposure to the open air. Again, some are so liquid as to penetrate the fibres of wood, while others are so viscid that their flow is scarcely perceptible. The rate of cooling also depends on many correlative circum-

stances ; and while the lava of Mauna Loa was covered with a crust which could be walked upon in a few days after eruption, that of Vesuvius has been known to remain red hot for years at a few feet beneath the surface.

Lázulite.—A mineral of a light-blue colour, known also as *azurite* and *prismatic azure-spar.* It is usually massive or disseminated in granular aggregations, and consists of a hydrous combination of phosphate of alumina and phosphate of magnesia, with protoxide of iron. Distinct from *Lapis-lazuli,* which it faintly resembles only in colour.

Lead.—A well-known metal of a bluish-grey colour; soft, flexible, and inelastic; and though ductile and malleable, yet possessed of very little tenacity. Its specific gravity varies from 11.3 to 11.4 ; its hardness is 1.5; and it fuses at a temperature of about 600° Fahr. In close vessels it does not appear to be volatile at a white heat, but melted in open vessels it soon oxidises and passes into a grey powder, which, upon further exposure to heat and air, becomes yellow, and is called *massicot* or *protoxide of lead.* If massicot be heated, and stirred to prevent fusion, it gradually absorbs oxygen, acquires a red colour, and is called *red-lead ;* and this red-lead, heated in nitric acid, is partly converted into a brown insoluble powder which is a *peroxide of lead.* By treating these oxides with acids we obtain *white-lead* or *carbonate of lead,* and *sugar of lead* or *acetate of lead*—preparations extensively used in the arts and in pharmacy. Lead is rarely found *native,* and that chiefly in volcanic rocks, where it appears as a product of fusion. Commercially, it is wholly obtained from the *ores,* and these occur in rocks and formations of all ages—almost always in veins, as in the metamorphic schists and carboniferous limestones of our own country. One of the most abundant and best known of its ores is *Galena—sulphuret of lead* or *lead-glance*—which has been taken as the representative of the LEAD-GLANCE FAMILY ; of less importance commercially, but of great mineralogical interest, occur the LEAD-SALTS FAMILY, which are usually associated with the former in crystalline forms less or more distinct.—See tabulations, "Mineral Scheme," for the species included under these respective families.

Lead, Black.—Known also as *Plumbago,* and technically and more properly as *Graphite*, which see.

Lead Glance.—An early and familiar term for the sulphuret of lead or *Galena,* which see.

Leadhillite.—A sulphato-tri-carbonate of lead, occurring in tabular crystals, or in foliated aggregates ; and so called from its being first found among the usual ores of Leadhills in Scotland.

Lead Ochre.—A massive, opaque, sulphur-yellow oxide of lead, occurring among volcanic products, but in other respects similar to the artificial yellow oxide.

Lead Spar.—The carbonate of lead, or *Cerusite ;* **Red-Lead Spar,** the chromate of lead or *Crocoisite,* both of which see.

Léelíte.—A species, or rather a variety, of compact felspar, of a reddish colour, found at Grythyttan in Westmannia, and so named after Mr Lee of Cambridge.

Legion (Lat.)—Literally, "a gathering or group." A term occasionally used in Natural History classification to express an assemblage of objects intermediate in extent between a *class* and *order.* A class may thus embrace several legions, and a legion contain many orders.

Leguminosítes (Lat. *legumen,* a pod).—Fossils occurring chiefly in ter-

tiary strata, and apparently the seeds of pod-bearing plants. About twenty species from the London Clay have been enumerated by Dr Bowerbank.

Lehm.—An ancient alluvium of the Rhine, better known as Loëss, which see.

Leiacánthus (Gr. *leios*, smooth, and *acantha*, a spine).—Literally "smooth spine;" a provisional genus of fossil fishes, the ichthyodorulites or fin-spines of which are found in the muschelkalk.

Léiodon (Gr. *leios*, smooth, and *odous*, *odontos*, tooth).—A generic name given to certain smooth mosasauroid teeth from the Chalk formations, in order to separate them provisionally from *Mosasaurus* proper, under which they were at one time included.

Lémnian Earth.—A variety of clay or aluminous earth, so called from the island of Lemnos in the Ægean Sea. It is of a yellowish-grey or white, with ochreous spots on the surface; has a meagre feel; adheres slightly to the tongue; falls to powder in water; and, according to some, seems to be only a decomposed trachyte. It has been used as a medicine from the time of Homer, and is sometimes termed *sphragide* (*sphragis*, a seal) or *terra-sigillata* from its being made up in cakes and stamped for the market. This earth, like the "*Armenian Bole*," has been the subject of innumerable fables and traditions. When Vulcan was hurled from heaven and fell on Lemnos, it stopped the bleeding of his wounds and bruises; subsequently it was used not only to stop bleedings, but as an antidote to poisons and the plague; and, from its reputation, has been greatly valued by all the successive possessors of the island, Greeks, Christians, and Mohammedans. Hence also the various stamps which it has successively borne—Diana, Vulcan, the Seal of the Grand Signor, and that of a goat, from the practice of working up the smaller and friable portions into a cake with goat's blood. If it has any medicinal properties, it is merely as an aluminous astringent.

Lentícular (Lat. *lens*, a lentil).—Resembling a lentil; having the form of a lens. Hence we speak of "lenticular concretions," "lenticular pebbles," &c.

Lénzinite.—One of the Clay family; a milk-white variety of *Halloysite* or semi-translucent silicate of alumina, consisting of 37.5 silica, 27.5 alumina, and 25 water, and named after Lenzins, a German mineralogist.

Lepadítes.—A term occasionally applied to fossil shells, apparently those of the goose-barnacle (*lepas*), as *balanites* is sometimes applied to those of the *balanus* or acorn-barnacle. The term has also been used to designate those bivalvular shell-like organisms, better known as *solanites*, *aptychus*, and *trigonellites*, the last of which see.

Lepidodéndron (Gr. *lepis*, a scale, and *dendron*, tree).—An abundant family of fossil plants, so called from the scale-like arrangement of the leaf-scars that adorn their stems. They are characteristic of the Upper Palæozoic strata, and especially of the Carboniferous system, in which they figure as one of the prevailing vegetable forms. They occur of all sizes, from mere twigs and branchlets to stems more than fifty feet in length, and often from three to five feet in breadth. A great number of species have been recorded, but many of these must in the mean time be regarded as uncertain and provisional. As regards the affinities of the family, botanists are by no means agreed, and it is more than likely that the Lepidodendron, like many other fossil plants, has no existing analogues. Thus, in the arrangement of their leaf-scars they resemble both the Coniferæ and Lyco-

pods; in their foliage they more resemble the Conifers; in their dichotomous ramification they are more like the Lycopods; while in their texture and size they seem more akin to the Coniferæ. "On the whole," says Professor Lindley, "we are led to conclude that the Lepidodendron genus was not exactly like either Coniferæ or Lycopodiaceæ, but that it occupied an intermediate station between those two orders, approaching more nearly to the latter than to the former." On the other hand, M. Brongniart, Dr Joseph Hooker, and other eminent botanists, concur in regarding them as gigantic arborescent club-mosses, of which *Lepidophyllum* was the leaf, and *Lepidostrobus* the fruit.

Lepidoidei, Lepidoids (Gr. *lepis,* a scale, and *eidos,* resemblance).—A family of ganoid fishes, characterised by their strong rhomboidal bony scales, and occurring in Carboniferous, Triassic, and Oolitic strata, but most abundantly in the latter. The scales of lepidoids are readily distinguished by the hook-like process on their upper margins, this process fitting, like the hook of a roofing-tile, into a corresponding depression on the lower margin of the scale placed immediately above it.

Lepídolite (Gr. *lepis, lepidos,* a scale, and *lithos,* stone).—A term applied to the fine pink-coloured varieties of *lithia-mica,* which differ chiefly from common or *potash-mica* in containing a considerable per-centage of fluorine, and from 2 to 6 per cent of lithia.

Lepidophýllum (Gr. *lepis,* scale, and *phyllon,* leaf).—Small lanceolate leaves occurring abundantly in the shales of the Coal-measures, evidently of a woody rigid texture, having a midrib, and triangular at the base or point of attachment. They are regarded as the leaves of *Lepidodendron;* hence the name.

Lepidósteus (Gr. *lepis,* scale, and *osteon,* bone).—*Bony Pikes;* a genus of malacopterygian or soft-finned fishes, remarkable for the hard, bony scales with which they are covered. The body is, as it were, encased in these, and the two outer rays of the tail and fins are fringed with them. There are only three or four species known, and these inhabit the lakes and rivers of the warmer parts of America. They belong to the GANOID order of Agassiz, and, along with the genus *Polypterus* or Bony Pike of Northern Africa, are almost the only living representatives of the numerous ganoid or enamelled-scale fishes of the secondary epoch.

Lepidóstrobus (Gr. *lepis,* a scale, and *strobīlus,* a fir-cone).—Fossil cone-like organisms occurring abundantly throughout the Carboniferous formation. There is considerable variety in their configuration, the arrangement of their scales, and the form of their bases or points of attachment; and while there is no doubt of their being reproductive bodies analogous to the cones of recent conifers and lycopods, there is still great difficulty in assigning the various forms to their proper places. In other words, while some may be the seed-cones of true Coniferæ, others may belong to the Lepidodendron and Ulodendron, to Cycadaceæ, or even to Calamites, with the stems of which they are so frequently associated.

Leptacánthus (Gr. *leptos,* slight, and *acantha,* a thorn or spine).—Literally "slender-spine;" a provisional genus of fossil fishes, so named by Agassiz, from their slender fin-spines, which are found in the Carboniferous Limestone, and in the Lias and Oolite. These ichthyodorulites are the only parts known; and it is more than likely that the "slender-spines" of the mountain limestone and of the Oolite belong to very different species of cestraciont fishes.

Leptólepis (Gr. *leptos,* slender, and *lepis,* scale).—Literally "slight or slender scale;" a genus of small sauroid fishes occurring in the Lias and Oolitic formations.

Leptopleúron (Gr. *leptos,* slender, and *pleuron,* rib).—Literally "slender-rib;" the name originally proposed by Professor Owen for the small reptile found in the upper Old Red of Elgin, now generally known by the generic term *telerpeton,* which see.

Leptospondýlus (Gr. *leptos,* slender, and *spondylus,* vertebra).—The generic term applied by Professor Owen to certain saurian vertebræ collected by Dr Orpen in the Drakenberg Mountains in Southern Africa.

Leucite (Gr. *leukos,* white).—Literally "white-spar;" a mineral allied to felspar, but by some taken as the type of a separate family. It is known also as *amphigene,* and is frequently associated with augite in lava, tufa, and other recent volcanic rocks. It consists, according to Klaproth, of 53.75 silica, 24.63 alumina, and 21.35 potash; and is remarkable as being the first mineral in which that chemist discovered that potash was a constituent of the mineral kingdom.

Leúcostine (Gr. *leukos,* white).—A Continental term for a white-coloured felspathic variety of lava.

Levant (Lat.)—Rising from below; the fourth of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the "Sunrise" of the North-American palæozoics; and the equivalents in part of our Lower Silurians.—See PALÆOZOIC FORMATIONS.

Level.—An English term for any flat alluvial plain of recent formation, in allusion to its usually level-like surface; *e.g.,* "Lewes Levels" and "Beeding Levels" in Sussex, "Bedford Level" in Lincolnshire, &c.

Levigation (Lat. *levigo,* I polish, from *lævis,* smooth).—The process of pounding or rubbing down earths and minerals to a powder or paste. It is generally done with a *muller* on a metallic or stone table, and some fluid added to assist the operation. In this respect it differs from *trituration,* which may be called the dry method.

Levyne.—One of the Zeolite family; a variety of *Chabasite,* occurring chiefly in amygdaloid and other trap-rocks.

Ley or **Lye.**—A technical term for a solution of any alkali, as soda or potash, in water.—See LIXIVIATION.

Lías, Liássic.—This term is said to be a corruption of *lyers* or *layers,* and was originally applied to those thin-bedded limestones occurring at the base of the Oolitic system—the layers of limestone being conspicuously separated by thin partings of clay. It is now extended, in geological classification, to that group or series of strata which in England immediately overlies the Trias or upper New Red Sandstone, and is in turn overlaid by the thick-bedded limestones of the Oolite proper. As developed in England, the Lias occupies a belt of variable breadth, extending from Lyme Regis in Dorset, northwards by Bath, Gloucester, Leicester, Newark, and Gainsborough to the Humber, and thence to the east coast of Yorkshire. Taken in Yorkshire, Northampton, and Somerset, the formation (according to Professor Phillips) exhibits in descending order the following members:—

1. *Upper lias clay or shale,* full of belemnites and other fossils, intercalated with or graduating into the sands of the inferior oolite, and in some cases containing nodules and bands of limestone.

2. *Marlstone.*—A suite of calcareous, sandy, and irony beds, very rich in fossils, and much analogous to the lowest beds of the lower oolite formation.
3. *Lower lias clay or shale,* full of fossil remains, interlaminated with bands and nodules of limestone, especially in the lower part, where a collection of these layers constitutes the "Lias rock."
4. *Lias rock.*—A suite of laminated limestones, with partings of clay, blue, grey, and white, the former in particular containing gryphites and other shells; the latter usually devoid of organic remains. This rock is sometimes consolidated into a united mass, and sometimes divided into separate portions.

For further details and foreign equivalents, see OOLITE SYSTEM, and preliminary tabulations, "Geological Scheme."

Licks. — An American term for swampy or boggy areas surrounding saline springs, the soil of which being impregnated with salt, or covered with saline incrustations, is *licked* by the wild cattle for the sake of the salt. Several of these seem to have been *licks* even during the upper tertiary period, for the surrounding soil contains the bones of the mastodon and other extinct mammals in such profusion (Big-bone Lick in Kentucky) as to warrant the conclusion that they were frequented by herds of these animals, just as they are by the herds of the present day.

Liévrite.—A brownish-black mineral, occurring in long vertically-striated prismatic crystals along with quartz, magnetic iron ore, and copper pyrites in veins in the crystalline strata, and consisting, according to Vauquelin, of 30. silica, 57.5 iron peroxide, and 12.5 lime. It is named after the discoverer, Le Lievre; and is also known as *Ilvaite,* from Elba, and *Yenite,* in commemoration of the battle of Jena in 1806.

Lígneous (Lat. *lignum,* wood).—Woody; having the texture or quality of wood; as "ligneous fibre," "ligneous stems," &c.

Lignite (Lat. *lignum,* wood).—Wood-coal or fossil wood more or less mineralised and converted into coal. The lignites are usually of a dull dark-brown appearance; compact or laminated, and revealing the woody texture; and never present the crystalline structure or pitchy lustre of true coal. They burn with much smoke and dull flame; are poorer in carbon or coke than common coal; give much less heat; and leave in general a large residuum of earthy ashes. Lignitic beds occur in the New Red Sandstone and Oolite, but chiefly in the Upper Cretaceous and Tertiary formations, and present a great variety of aspects, some being almost as hard as true coal, and known as "stone-coal;" others being distinctly woody, and hence called "wood or board coal;" some again consisting of thin layers like compressed leaves, "paper-coal;" and others soft and earthy, and known as "peat-coal." Lignite thus passes, it may be said, through every gradation of texture, from the compacter peat-beds of the present day to the stone or mineral coal of the older formations. The well-known lignites or "*Brown Coals*" of Germany and the continent of Europe are chiefly tertiary, and from the leaves, fruits, and stems of palms (fan-palm, date-palm, cocoa-nut-palm, &c.) which they contain, give evidence of the more genial climate of these latitudes during the Tertiary epoch.—See COAL, and TERTIARY FORMATION.

Lignitíferous (*lignite,* and *fero,* I yield).—Applied to strata or formations which contain subordinate beds of lignite or brown-coal.

Lígulate (Lat. *ligula,* a strap). — Strap-shaped; applied in Natural

History to objects, organs, and processes which are long and narrow like a strap.

Lígurite (from *Liguria*).—A mineral of an apple-green colour, consisting of silicate of alumina, lime, and magnesia; occurring in mica- and talc-schists; and from its colour, hardness, and transparency, used as a gem.

Lily-Stone, Lily Encrinite.—Familiar terms for the common Encrinite, from the fanciful resemblance of its stalk and clustered tentacles to the stem and flower of a lily.—See Encrinite and Crinoidea.

Limbelite.—A subordinate variety of olivine or chrysolite, so named by Saussure, from the volcanic hill of Limbourg, where it occurs.

Lime.—Chemically, the protoxide of *calcium*, one of the metallic bases discovered by Davy in 1807. Mineralogically, one of the primitive earths, usually occurring in nature as a *limestone* or carbonàte of lime, from which it is obtained by roasting at a red-heat so as to expel the carbonic acid, and thus leave the lime or *quick-lime* behind. If the limestone employed be very pure, as white chalk or Carrara marble, the residue will be the earth "lime"—white, very infusible, highly luminous when heated to full redness, and of a specific gravity about 2.3. It requires for solution about 500 parts of water, but diluted as this may appear, it acts powerfully as an alkali; has an acrid taste; and is thence regarded as one of the *alkaline earths*. If quick-lime be sprinkled with water, it rapidly crumbles down to powder with great evolution of heat, and becomes *slaked lime* or *hydrate of lime;* and if this hydrate continue exposed to the air it gradually absorbs moisture and carbonic acid, and is reconverted into the *carbonate*. Combining readily with acids, the *salts of lime* occur abundantly in nature as *sulphate of lime* or gypsum; *fluate of lime* or fluor-spar; *phosphate of lime* or apatite; and so forth. The most abundant compound, however, is the *carbonate of lime* or ordinary limestone, which occurs in all states of purity, and in all stages of mineralisation—from soft earthy chalk to crystalline limestones or even transparent crystallised calc-spars. As an earth, lime is profusely disseminated in nature: as a rock it enters largely into the composition of the earth's crust; it is less or more diffused in all its waters; it forms the principal ingredient (earth of bone) in the skeletons of the larger animals; and is secreted by many classes of the invertebrata to form their shells, crusts, shields, corals, and other means of protection. Economically it is also of vast importance, being used in the manufacture of mortars and cements, in tanning, bleaching, deodorising, and the like, and also in agriculture as a fertiliser, or promoter of vegetable decay.

Limestone.—The familiar as well as technical term for all rocks and rock-masses that are mainly composed of carbonate of lime, and are in their texture either earthy (chalk), compact (ordinary limestone), or crystalline (marble)—crystallised varieties of the carbonate being better known as *calc-spars*. Limestones occur in all formations; in all degrees of purity; and owe their origin—some to corals, encrinites, and shell-fish, others to accumulations of foraminiferous and kindred organisms, and others again to chemical precipitation from the waters in which they were deposited. The names by which their varieties are known to the geologist have reference to their origin, composition, texture, or other physical property, as "encrinal limestone," "shell limestone," "magnesian limestone," "saccharoid limestone," "concretionary limestone," and the like. The quality or richness of a limestone is in general perceptible to

the eye; and where this fails to satisfy, the application of sulphuric or muriatic acid (both of which dissolve limestone with violent effervescence), or the heating of a fragment before the blowpipe so as to convert it into quick-lime, will without much trouble give the necessary indication.

Limnacínæ and **Limneidæ** (Gr. *limnê*, a marsh).—Terms applied to the River-snails; a sub-family of the HELICINÆ or true Snails, and represented by the well-known marsh shells *limnœa, physa,* and *planorbis.*

Limnæa (Gr. *limnaios,* marshy). — The "Pond-shell;" a well-known genus of fresh-water molluscs inhabiting lakes and ponds, and characterised by their pointed spire, elongated oval body, and delicate thin shell. About seventy species occur in tertiary strata; the existing species are somewhat fewer in number.

Limpid (Lat.)—Clear, pure, transparent. Applied to fluids and crystals.

Límulus.—The Molucca-crab, king-crab, or horse-shoe crab. A genus of crustaceans belonging to the family *Xiphosura* or sword-tails, and to the order *Pœcilipoda,* or those having feet of different forms. In the limulus the dorsal plates are united in one piece or carapace; the abdominal shield is more complex; of the feet some are leaf-like and fitted for swimming, others are shear-shaped and perform the office of jaws, hence the term "jaw-feet." The tail is long, spear-shaped, and pointed. There are few species of existing limuli: several *limuloid* crustaceans have been discovered in the coal-measures; but of these some may likely belong to the *Eurypteridœ,* which are altogether fossil.

Line of Dip and **Line of Bearing.**—The direction in which strata dip or incline from the horizon is said to be the "line of dip;" the direction of their strike or outcrop "the line of bearing." As the *dip* is always at right angles to the *strike*—if the one is known, the other can readily be laid down; thus, if the dip be to the N.W., the line of bearing will run from S.W. to N.E., and *vice versâ.*

Língula (Lat., a little tongue).—A genus of brachiopodous mollusca, so called from the tongue-like form of their valves. In the Lingula the two valves are nearly equal, of a horny texture, rather compressed, somewhat truncated in front, the hinge toothless, the beak of the valves rather pointed, and united to a tendinous pedicle by which the animal is attached to the sea-bottom. The existing lingulæ are found only in southern seas; the fossil species, nearly forty in number, occur in all formations from the Lowest Silurian upwards, being found in British strata so recent as the Coralline Crag. The *Lingulidœ* are thus one of the oldest families of mollusca—several species being highly characteristic of, and peculiar to, the lowest fossiliferous strata with which Geology is yet acquainted.

Língulate and **Linguiform** (Lat. *lingua,* the tongue).—Applied to leaves and other organisms which are shaped like the tongue; tongue-shaped.

Linnæan.—Systems of classification, nomenclature, and methods introduced by Linnæus the great Swedish naturalist, who was born in 1707, and died in 1778, are so termed. The *Linnœan Systems* are often spoken of as *Artificial,* in contradistinction to the more *Natural* systems introduced by Jussieu in Botany, and by Cuvier in Zoology.

Liquefaction (Lat. *liquefacio,* I make liquid).—Literally, the passing of a substance from the solid to the liquid state, as the melting of ice; but also often used as synonymous with *fusion, solution,* and *deliquescence.*

Líthia (Gr. *lithos,* a stone).—An alkali or alkaline earth, discovered in 1818 by Arfwedson in a mineral called *petalite,* but since found in other

minerals, and in very minute quantities in some mineral springs, as those of Carlsbad. As an earth it is caustic, alkaline, and sparingly soluble in water. It obtains its name from being found only in the mineral or stone kingdom.

Lithium.—The metallic base, of which *lithia* is the oxide, first obtained by Sir H. Davy from the hydrate of that earth by the action of the galvanic battery. Like *sodium*, &c., it is a white-coloured metal, but so exceeding oxidable that its properties cannot be fully examined.

Lithocarp (Gr. *lithos*, and *carpos*, fruit).—Any fossil fruit; same as *Carpolite*, which is the term principally used.

Lithódomi, Lithodomous (Gr. *lithos*, and *domos*, a house).—Applied to certain mollusca, which, like the *pholas*, bore into solid rocks and form for themselves permanent lodgments—the perforation widening as the animal grows larger, and descends the deeper. It has been a long-discussed question among naturalists whether the perforation is made by mere mechanical rasping, or by the secretion of some chemical solvent; but the fact seems now well ascertained that the boring is performed solely by gradual and incessant friction.

Lithógenous (Gr. *lithos*, stone, and *ginomai*, I beget).—Applied to polyps which secrete or build up stony structures, as the Coral-polype.

Lithográphic Limestone, Lithographic Slate.—A peculiar magnesian limestone, slaty, compact, and fine-grained, usually obtained from the Lias and Oolite, and extensively employed in lithography. The finest stones are from Solenhofen and Pappenheim in northern Bavaria, but some of fair quality have been procured from the Lias of England. The most esteemed colour is a pale cream-yellow, but excellent slabs of bluish-grey are not uncommon.

Lithoidal (Gr. *lithos*, and *eidos*, appearance).—Stone-like; having the texture or appearance of stone.

Lithólogy, Lithological (Gr. *lithos*, a stone, and *logos*, doctrine).—Applied to the physical characteristics or stratigraphical relations of rock-groups, in contradistinction to their palæontology or palæontological aspects. *Lithology* or *Petralogy* treats of the earth's crust as made up of mere inorganic rock-masses, and endeavours to discover their composition, origin, and the successive changes to which they may have been subjected; leaving to *Palæontology* all that relates to the fossils they contain, as manifestations of the life that has successively peopled the Earth's surface.

Líthomarge.—Literally "stone-marrow;" a term applied to several varieties of clay or fine-grained silicate of alumina, arising in some cases from the decomposition of felspathic rocks, and in others from the deposition of aluminous springs. It is of various colours, striped and spotted; is massive, soft, and opaque; adheres strongly to the tongue; falls to powder in water, but does not form a paste, and has a greasy feel when containing a little magnesia, as is the case with some varieties. What is called *Hard lithomarge* is a more complex compound of a blue mottled colour, found in the coal formation of Planitz in Saxony, and known as the *Terra Miraculosa Saxoniæ*, from its supposed medicinal virtues.

Lithóphagi, Lithophágidæ (Gr. *lithos*, and *phago*, I eat).—Applied to those shell-fish and other animals which bore holes, and form for themselves a lodgment, in limestone, coral, and other stony masses. Certain fish like the *Scarus*, and many of the *Holothuriæ*, are said to be *lithophagous*, as browsing and subsisting on the living coral.

Lithophýllum (Gr. *lithos,* and *phyllon,* leaf).—Volkmann's term for the stigmaria; and like *phytolithus,* which was Martin's designation for the same plant, often found in the older geologists.

Lithophýta or **Lithophytes** (Gr. *lithos,* and *phyton,* a shoot).—Literally "stone-plants;" those polyps which secrete a stony axis, as the Corals, in contradistinction to *Ceratophyta,* or those which secrete a horny axis, like the *Gorgonia* or Sea-fan.

Lithórnis (Gr. *lithos,* stone, and *ornis,* bird).—Literally "petrified bird;" a generic term applied by Professor Owen to certain bird-remains from the London or eocene clay of the isle of Sheppey. From the close resemblance of these bones to those of the vulture tribe, they are designated specifically as the *Lithornis vulturinus.*

Littoral (Lat. *littus,* the sea-shore).—Belonging to, inhabiting, or taking place on the shore. Applied to operations and deposits which take place near the shore, in contradistinction to those of a deep-water or *pelagic* character.

Líttoral Cóncrete.—" This term, which is of Bombay origin (we quote Dr Buist of that town), indicates distinctly and intelligibly a particular variety of rock, formed by the cementation of sea-sand or shells—the same as those now prevalent along our shores." The rains of certain regions are more surcharged with carbonic acid than others, and where this is the case "littoral concrete," often of great hardness and durability, is sure to be formed, by the action of these carbonated waters on the shells and other calcareous matter of the sands—the dissolved lime acting as the cement in artificial *Concretes,* which see.

Littoral Zone (Lat. *littus,* the shore).—That zone of marine life which lies between high and low water mark (varying in extent according to the rise and fall of the tide, and the shallowness of the shore), and which in British seas is characterised, as the bottom may be rocky, sandy, or muddy, by such mollusca as the periwinkle, limpet, mussel, cockle, razor-shell, &c., and by such plants as the bladder-wrack, dulse, and carigeen. —See ZONE.

Lituítes (Lat. *lituus,* a trumpet).—A genus of chambered shells peculiar to silurian strata, and so named from their form—their whorls being partially coiled up at the smaller end, and the last chamber being produced into a straight trumpet-like tube. The lituite is ranked under the *nautilidæ;* has the septa outwardly concave, and the siphuncle internal.

Litúolite (*lituola,* diminutive form of *lituus*).—A genus of minute foraminifera, so called from their spiral form and straight prolonged outer whorl; occur chiefly in the chalk formation.

Liver Ore.—The *Hepatic cinnabar* of Phillips; a dark liver-coloured variety of sulphuret of mercury intimately intermixed with idrialite (Tosia in Spain), carbon, and earthy matter.

Liver Pyrites.—A familiar term for a liver-coloured concretionary variety of sulphuret of iron having an internal radiated texture.

Lixíviation (Lat.)—The process of extracting the saline matter of bodies, more especially of ashes (as *kelp*), by means of steeping and washing in water. Such a solution is called a *ley, lye,* or *lixivium,* and the salts resulting from its evaporation *lixivial salts.*

Llandóvery Rocks.—A term applied by Sir R. Murchison to certain sandstones and shales which seem to form a connecting link between the Lower and Upper Silurian series of South Wales. They are specially char-

acterised by *Pentamerus*, *Atrypa*, and *Petraia*, and derive their name from the locality where their relations are most clearly developed.

Llanos (Span.)—In Physical Geography, the flat treeless plains that extend along the banks of the Orinoco. They are, for the most part, within the tropics, and during one half of the year are covered with grass, and for the rest desolate. They are of very recent alluvial growth, and are partly still in progress of formation.

Loadstone or **Lodestone.**—A familiar term for the *magnet*, which see; an ore of iron that possesses the peculiar property of attracting iron, and which, when freely suspended, invariably turns towards the North Pole or "Magnetic North."

Loam (Sax.)—A general, but not very definite term, applied to soils that are native admixtures of clay, sand, and vegetable mould—as being moderately cohesive, less tenacious than clay, and more so than sand. Agriculturists speak of *light* and *heavy* loams according to the proportion of clay they contain; and also of *sandy, calcareous,* and *gravelly* loams, just as sand, lime, or gravel happen to be characteristic ingredients.

Lode.—A Cornish term for any regular vein or course, whether metalliferous or merely composed of veinstone. In the former instance they are said to be *alive*, in the latter they are termed *dead* lodes.

Loess or **Lehm.**—A German term for an ancient alluvial deposit of the Rhine replete with fresh-water shells of existing species. According to Lyell, "it is a finely-comminuted sand or pulverulent loam of a yellowish grey colour, consisting chiefly of argillaceous matter, combined with a sixth part of carbonate of lime, and a sixth of quartzose and micaceous sand." Interstratified with it are volcanic ashes thrown out by the now extinct volcanoes of the Eifel and adjacent districts, and the Rhine has since eaten out a passage, frequently leaving exposed cliffs of considerable altitude. In general it ranges from thirty to fifty feet in thickness; is found as much as 1500 feet above the present sea-level; and where it terminates near Switzerland, it is said to repose on rolled flints and pebbles of the Older Drift period.

Logan-Stones.—Properly "Logging-stones," and perhaps better known as "Rocking Stones;" weather-worn blocks so finely balanced on their pivot-like bases that a very ordinary force suffices to make them "log," or "rock" from side to side. The following description, by Dr Paris, of the celebrated Logan-stone near the Land's End, conveys an intelligible idea of the nature and origin of these curiously-poised blocks. "The foundation of this part of the coast of Cornwall is a stupendous group of granite rocks, which rise in pyramidal clusters to a great altitude and overhang the sea. The celebrated Logan-stone is an immense block, weighing above sixty tons. The surface in contact with the under rock is of very small extent, and the whole mass is so nicely balanced, that, notwithstanding its magnitude, the strength of a single man applied to its under edge is sufficient to make it oscillate. It is the nature of granite to disintegrate into rhomboidal and tabular masses, which, by the further operation of air and moisture, gradually lose their solid angles and approach the spheroidal form. The fact of the upper part of the cliff being more exposed to the atmospheric agency than the parts beneath, will sufficiently explain why these rounded masses so frequently rest on blocks which will preserve the tabular form; and since such spheroidal blocks must obviously rest in that position in which their lesser axes are perpendicular to the horizon, it

is equally evident that, whenever an adequate force is applied, they must vibrate on their point of support."

Lonchópteris (Gr. *lonché*, a spear, and *pteris*, fern).—Literally "Spear-leaf;" a fossil fern-like frond occurring in the Coal-measures, Lias, Oolite, and Wealden, and so called from its resemblance to the recent *Lonchitis*. The leaves are many times pinnate; leaflets adherent to each other at their base, traversed by a midrib, and furnished with reticulated veins.

London Clay.—One of the members of the Lower Tertiary or Eocene beds of the London basin, and so called from its being largely developed under, and in the vicinity of, the metropolis. It consists of a tenacious bluish-black clay, varying from 300 to 600 feet in thickness, enclosing numerous bands of septaria, and (along with the accompanying strata) abounding in marine shells of extinct species—crabs, lobsters, and other crustaceans—teeth of sharks and many other genera of fishes—bones of crocodiles, turtles, serpents, and birds—leaves, fruits, stems of plants, and rolled trunks of trees perforated by boring mollusca—all indicating a warm and genial climate.—See TERTIARY SYSTEM.

Longmynd Rocks.—In geological classification the terms "Longmynd Rocks" or "Bottom Rocks" are meant to embrace all those unfossiliferous, or but sparingly fossiliferous, conglomerates, grits, schists, and slates, which lie at the base of the Silurian System. They are typically developed in the Longmynd Hills, Shropshire (whence the name); are regarded by the Government Geological Surveyors as constituting the "Cambrian System;" but are still retained by Professor Sedgwick as the mere basis or under-group of his original "Cambrian Rocks."

Lophíodon (Gr. *lophion*, a small crest or ridge, and *odous*, tooth).—An extinct tapir-like pachyderm of the tertiary epoch; so called from certain points or eminences on its teeth. Several species have been catalogued, but as yet very little is known as to its true relationship.

Lóricated (Lat. *lorica*, a coat of mail).—Covered or clad with horny or bony plates or scutes, like the alligator and crocodile.

Lóxodon (Gr. *loxos*, oblique, and *odous*, tooth).—One of the sub-genera into which Dr Falconer divides the elephants. The term has reference to the rhomb-shaped discs of the worn molars; and comprises both extinct and living species.

Lucullite.—A variety of black marble, so called from its being first brought by Lucullus to Rome, from an island in the Nile.

Ludlow Rocks.—According to Murchison, the uppermost group of the Silurian system; and so termed from being characteristically developed near the town and castle of Ludlow, in Shropshire. They consist, in that district, of thin flaggy sandstones (tilestones); of shales with calcareous bands; and of limestones (Aymestry limestone)—all highly fossiliferous. —See SILURIAN SYSTEM.

Lumachéllo (Ital.)—A variety of marble full of fossil shells, exhibiting beautiful iridescent colours, sometimes deep red or orange, when it is known by the name of *Fire-marble*.

Lumbar (Lat. *lumbus*, the loins).—Pertaining to the loins, as "lumbar muscles," "lumbar vertebræ," &c.

Lustre (in Rocks and Minerals).—Lustre, like colour, fracture, cleavage, &c., is often taken as a characteristic of minerals and rock-compounds, but cannot be well described without the inspection of actual specimens.

It refers to the intensity and quality of the light reflected from their newly-fractured surfaces, and in this respect differs from colour, which is an inherent property. Several degrees of intensity have been named by mineralogists; as *Splendent*, when a mineral reflects the light so as to be visible at a distance, and well-defined images are formed on its surface, as in galena and rock-crystal; *Shining*, when it is weaker and cloudy, and images only are formed, as in heavy-spar; *Glistening*, when the light is not observable at greater distance than an arm's length; *Glimmering*, when only a number of small shining points are observable near the eye, as in crystalline limestone; and *Dull*, when no lustre can be discerned, as in Chalk. The kind or quality of lustre is also defined by such terms as *Metallic*, seen in pyrites and glance-coal; *Adamantine*, as seen in the diamond; *Vitreous*, as in glass or rock-crystal; *Resinous*, as in pitchstone and garnet; *Pearly*, as in some gypsums, talc, and mica; and *Silky*, as seen on the polished surfaces of amianthus. These degrees and qualities often shade insensibly into one another, and though exceedingly useful in description, often require a very practised eye to distinguish between them.

Lusus Natúræ.—Literally "sport or freak of nature." A frequent term of the older naturalists for any appearance or production that seemed to lie out of the ordinary course of nature's operations. Thus fossil organisms were regarded as "*lusus naturæ*" by those who believed that the earth's crust was the result of one simultaneous act of Creation, and not the result of long-continued operations, such as those that are now taking place around us.

Lycopodiáceæ.—A natural order of Cryptogamic or flowerless plants, of which the *lycopodium* or club-moss has been taken as the type. In their tissues and mode of fructification the club-mosses resemble ferns; in their foliage they approach the coniferæ; and in their general aspect they are like the mosses; hence they are said to stand intermediate between the Conifers and Ferns on the one hand, and the Ferns and Mosses on the other. Their stems divide by forking repeatedly, and are closely covered with simple leaves, which are arranged in two rows, having their edges vertical with respect to the axis of growth, and not horizontal. These leaves are placed alternately, and are furnished with smaller lateral leaflets of the nature of stipules. The scars left by the leaves arrange themselves spirally round the stem, and in this arrangement, as well as in their rhomboidal or lanceolate shape, greatly resemble the leaf-scars of the Coniferæ.—See LEPIDODENDRA and CONIFERÆ.

Lycopodítes.—Fossil plants apparently allied to the Lycopodiums or club-mosses of the present day. They occur in the Tertiary, Secondary, and upper Palæozoic strata—those of the Coal-measures being represented by gigantic arborescent species.

Lýdian Stone.—Flinty slate; a mixed siliceous rock, usually of a greyish-black colour, splintery or conchoidal fracture, and keen cutting grain. It is common in many countries, and has long been used as a touchstone for gold, whose purity is shown by the colour of the streak which it leaves on the smoothened surface of the touch-slate. It often passes insensibly into *jasper*, *hornstone*, and other allied siliceous rocks; and hence is sometimes known as "black-jasper."—See BASANITE.

Lye or **Ley.**—A solution of an alkaline substance, as potash or soda, in water.—See LIXIVIUM.

M

Macácus.—The Bonnet-apes, or Ape-baboons. A genus of Old World monkeys, belonging to the group *Cercopithecina* and family *Simiidæ;* characterised by having a fifth tubercle on their last molars; ischial callosities and cheek-pouches; comparatively short and thick limbs; a projecting muzzle and prominent eyebrows; and generally very short tails. According to Owen, remains of a genuine ape have been found in the pliocene deposits of Essex, and still earlier in the eocenes of Suffolk; hence the species *Macacus eocænus.*

Maccagnóne.—The Grotta di Maccagnone; an important ossiferous cavern situated in the Hippurite limestone, westward of the Bay of Carini (between Palermo and Trapani), and containing the usual cave-remains of elephants, hippopotami, rhinoceroses, bears, hyænas, horses, deers, &c., in the main mass of stalagmite; and in the upper layers, bits of carbon, and abundance of flint and agate knives of human manufacture.

Macerátion (Lat. *macerare,* to make soft by steeping).—The steeping of vegetable or animal substances in a cold liquid till their tissue or fibres become softened, and part more readily with any peculiar principle (oily, aromatic, &c.) which they may contain. *Infusion* is performed by pouring the hot liquid over them; *decoction,* by boiling them in it for a longer or shorter period.

Macháirodus (Gr. *machaira,* a sabre, and *odous,* tooth).—A genus of carnivorous mammals found in the miocene, pliocene, and pleistocene tertiaries and bone-caves of Europe; and so called from the trenchant, sharp-pointed, sabre-shape of its upper canines. There were several species, some as large as the grizzly bear and lion, others about the size of the leopard and under. Professor Owen finds its nearest affinities in the lion; hence his synonym of *Felis spelæa.*

Macígno or **Macigna Piétra.**—An Italian term for a hard siliceous sandstone, apparently of cretaceous age, imbedding calcareous grains, &c., and occurring interstratified with the fine saccharoid marbles of Carrara.

Macled (Lat. *macula,* a spot).—Literally "spotted;" applied to surfaces that are covered with spots of a hue deeper than, or different from, the main ground of the substance. Some sandstones, for example, are macled with reddish spots of iron peroxide; some clay-slates macled with crystals of iron-pyrites.

Macles.—Applied in Mineralogy to "twin-crystals," which are united by simple contact of their faces, by interpenetration, or by incorporation. These twin forms are often repeated so as to form groups or compound macles. *Chiastolite* (which see), from the twin form of its crystals, is not unfrequently termed "*Macle.*"

Maclúrea (after Dr Maclure).—A genus of flatly-spiral operculated shells, often of large dimensions, and especially characteristic of Lower Silurian strata. The species differ in the convexity and number of the whorls. Supposed by some to be gasteropod; but the character of the

spiral operculum or small upper valve inclines Mr Woodward to regard it as an ancient form of the RUDISTA or HIPPURITE group, which see.

Maclúreite (after Dr Maclure). — One of the gems, known also as *Brucite, Hemiprismatic Chrysolite,* and *Chondrodite,* which see.

Macrauchénia (Gr. *makros,* long, and *auchen,* the neck). — Literally "long-neck;" an extinct tertiary mammal of South America, having the nearest affinities to the existing *llama* of that continent, but of more gigantic dimensions, and standing intermediate, as it were, between the camels and llamas.

Macro— (Gr. *makros,* large). — A frequent prefix in natural science, signifying *large;* as *macro-cephalous,* large-headed; *macro-dactylous,* long-toed; *macro-podal,* large-footed; *macro-urous,* long-tailed, &c.

Macropóma (Gr. *makros,* large, and *poma,* operculum).—A genus of sauroid fishes peculiar to the Chalk and Wealden, and so named from its large opercula—the head being equal to one-fourth of the entire length of the body, which in full-grown specimens was about two feet. In the *macropoma* the scales were large, and the anterior dorsal fin armed with spines. The coprolites, which often contain scales of other fishes, show that it was carnivorous in its habits.

Macróura, Macrúra (Gr. *makros,* long, and *oura,* tail).—A family of decapod crustaceans, characterised by the large size of the tail, as in the common lobster; and distinguished from the *brachyoura* or short-tailed, like the crab. Both families are found fossil in secondary and tertiary strata; but in the palæozoic only the *macroura* are as yet known.

Mactra (Gr., a kneading-trough). — A well-known littoral bivalve inhabiting sandy and muddy shores ranging from ten to twelve fathoms in depth, and so named from a fanciful allusion to its shape. There are several species, recent and fossil; the latter occurring only in the upper tertiaries.

Madrepore (Fr.)—Literally "spotted-pore;" an extensive genus of coral-building polypes, whose stony secretion is characterised by its spreading or branching form, and by the numerous star-shaped cavities that dot its surface, each cell being the abode of a single but united polype. The term is more frequently applied to the stony-coral than to the polype—madrepores being amongst the most abundant corals in the reefs of existing seas.

Madreporite.—Fossil madrepore; also a variety of limestone having a small prismatic or columnar structure which looks like the pore arrangement of coral, but which in reality is a species of crystallisation.

Mæstricht Beds.—"On the banks of the Meuse, at Mæstricht," says Lyell, "reposing on ordinary white chalk with flints, we find an upper calcareous formation about 100 feet thick, the fossils of which are on the whole very peculiar, and all distinct from tertiary species. The upper part of the rock, about 20 feet thick, abounds in corals and bryozoa; these beds are succeeded by a soft yellowish limestone 50 feet thick; and the stone below is white, and encloses occasional nodules of grey chert and chalcedony." These so-called "Mæstricht beds," from containing *belemnites, hamites, baculites,* &c., are regarded as the uppermost member of the Chalk formation in Europe; they are wanting in England; and in geological classification are erected into a group which embraces the *calcaire pisolitique* near Paris, the *Mæstricht beds* proper, and the *coralline limestone of Faxoe* in Denmark.—See CRETACEOUS FORMATION.

Magnésia.—One of the alkaline earths, a light whitish substance occurring abundantly in nature in various states of combination. It is found native in veins of serpentine, forming a *hydrate of magnesia* (69 magnesia and 31 water), but soon passes into the carbonate on exposure to the air. Magnesia enters largely into the composition of many primary rocks (steatite, serpentine, talc, &c.), giving to them a soft soapy feel: as a *carbonate*, in combination with carbonate of lime, it constitutes magnesian limestone, found extensively in the secondary and palæozoic strata; as a *sulphate*, it is common in many waters, as those of Epsom, Seidlitz, &c.; as a *muriate*, it is found in the waters of the ocean; and other combinations, as *borates*, *silicates*, &c., are by no means rare. The origin of the word is conjectural; some deriving it from the city *Magnesia;* others from an old term applied to such substances as had the power of attracting some principle from air or water.

Magnésian Limestone.—Any limestone containing upwards of 20 per cent of magnesia may be so called. The term is often used by English geologists as synonymous with Permian or Lower New Red Sandstone—magnesian limestone being largely developed in that formation in the North of England. As magnesian limestones occur, however, in other formations, the term should be regarded as descriptive of a rock merely, and not as the synonym of any stratified series. Magnesian limestone, in its compacter states, forms a most durable building-stone; and on assuming the semi-crystalline and crystalline state passes into *Dolomite.*—See PERMIAN SYSTEM.

Mágnesite.—A compact amorphous carbonate of magnesia, usually found in serpentine rocks, white or greyish-white, and consisting in its purest state of about 51 magnesia, and 49 carbonic acid.

Magnésium.—The metallic base of magnesia, a silvery-looking metal, which fuses at a red heat, and on burning passes into magnesia or oxide of magnesium (61.4 magnesium, and 38.6 oxygen).

Magnet (said to be from *Magnesia*, where the loadstone, or native magnetic iron, was found in abundance).—Magnets are defined as "substances which attract certain metals; which display towards one another a force partly attractive and partly repulsive; and which exhibit a tendency to arrange their mass in certain directions or according to a law of *polarity*." They are spoken of as *natural* and *artificial*—the former being the "loadstone" or native magnetic iron, and the latter certain arrangements of steel bars to which the magnetic property has been communicated by induction, and known as "bar-magnets," "horse-shoe magnets," "compound magnets," &c. When the artificial magnet is left to move freely on a pivot or otherwise, as in the mariner's compass, it is spoken of as a *needle*, and invariably assumes a definite direction as regards the earth, this direction being towards the *magnetic north* or *magnetic pole*.

Magnétic Fluid.—The hypothetical natural agent to which the various phenomena of magnetism are usually referred, and spoken of as a *fluid* from its continuous motion or flow in certain fixed directions.

Magnétic Iron Pyrites.—Known also as *rhombohedral iron pyrites*, and *pyrrhotine*, a native sulphuret of iron occurring in tabular or short prismatic crystals of a bronze-yellow or copper-red colour, and more or less magnetic. It is found chiefly in veins with other ores in the igneous and older crystalline rocks.

Magnétic Meridian, Magnetic North.—The mean direction which a freely

suspended horizontal needle assumes when left to itself is termed the "magnetic meridian," in contradistinction to the true meridional north and south as indicated by the sun's shadow at noon. The magnetic meridians coincide with the geographical meridians in some places, and in these the magnet points to the true north and south; that is, to the poles of the earth's rotation. But if it be carried successively to different longitudes, it will deviate sometimes to the east and sometimes to the west of the true north. This deviation appears to be secular; in other words, to oscillate within certain limits in a given time. Thus in 1660 the needle pointed due north in London; after 1662 it began to diverge to the westward, till in 1815 it pointed 24° 15′ west of north. Since 1815 it has been gradually returning from this extreme divergence, till now, in the British Islands, the geologist has to allow from 22° to 26° for his compass bearings. The dip and strike of strata, lines of fault, veins and cleavage, axis of elevation, and the like, are almost invariably laid down in reference to the true meridian.

Magnetic Needles.—The magnetised bars of steel known as "magnetic needles" are of two kinds—the *declination-needle* and the *dipping-needle.* The former, as seen on the common mariner's compass, revolves in a horizontal direction, and points to the magnetic north; the latter moves in a plane perpendicular to the horizon, and dips more and more as we approach the magnetic poles, where its position becomes vertical.

Magnetic Poles. — In the northern hemisphere the north end of the dipping-needle leads or dips to the north; in the southern hemisphere the south end dips to the south; but between the two there is a line encircling the whole earth where the needle remains horizontal. This line is termed the *magnetic equator,* or "line of no dip." As we proceed northwards or southwards of this line the needle dips more and more till at last it becomes vertical or perpendicular to the horizon in two points, or rather linear spaces, which are known as the north and south *magnetic poles.* These poles differ from the poles of the earth's rotation—the north, as determined by Sir J. Ross, being in 70° N. lat. and 97° W. long.; and the south in 75° 5′ S. lat. and 154° 8′ E. long.

Mágnetism.—Literally, the attractive and repulsive power of the natural magnet or loadstone; generally, that peculiar property possessed by many mineral bodies and by the whole mass of the earth itself, by which, under certain circumstances, they mutually attract and repel one another, according to determinate laws. "Very delicate experiments have shown that all bodies are more or less susceptible of magnetism. Many of the gems give signs of it; titanium and nickel always possess the properties of attraction and repulsion; but the magnetic agency is most powerfully developed in iron, and in that particular ore of iron called *loadstone* or *magnetite.* A metal is often susceptible of magnetism if it contain only the 130,000th part of its weight of iron—a quantity too small to be detected by any chemical test. One of the most distinguishing tests of magnetism is *polarity,* or the property a magnet possesses, when freely suspended, of spontaneously pointing nearly north and south, and always returning to that position after being disturbed. *Induction* is the power which a magnet possesses of exciting temporary or permanent magnetism in such bodies in its vicinity as are capable of receiving it. By this property the mere approach of a magnet renders iron or steel magnetic—the more powerfully, the less the distance. Iron acquires magnetism more readily than steel, yet it loses it as quickly on the removal of the magnet, whereas

the steel is impressed with a lasting polarity. There can hardly be a doubt but that all the phenomena of magnetism, like those of electricity, may be explained on the hypothesis of one ethereal fluid, which is condensed or redundant in the positive pole, and deficient in the negative."—(*Mrs Somerville, as abridged by Dr Humble*). While there can be little doubt of the identity of magnetism with electricity (since magnets can be made to exhibit all the phenomena of electrical machines), still it must be regarded in great measure as one of those unseen existences which are only known by their effects. Terrestrial magnetism, which pervades the whole earth, and with which geologists have most to do, is a subject of extreme complicity; and though often called in by the theorist to aid him in his views respecting crystallisation, cleavage, jointing, and other phenomena, it must be fairly admitted that science is not yet in a position to point out either the extent of its results or its precise mode of working.

Mágnetite.—Known also as *magnetic iron, oxidulated iron,* and *octahedral iron-ore,* consists of about 69 iron peroxide, with 31 iron protoxide. It occurs largely in the igneous and metamorphic rocks, either in distinct crystals, disseminated through the mass, or more frequently in compact beds, forming, as in Norway, Sweden, and Russia, a most important ore of iron. It rarely appears in veins; and the largest known masses are situated in the northern parts of the globe—Scandinavia, Russia, Siberia, and North America.

Mailed (Fr. *maille,* a coat of armour).—Having the body protected by a coat or covering of scales, bony-plates, or other hard substance; *e.g.*, the Armadillo, Glyptodon, &c.

Málachite.—The green carbonate of copper, consisting of 71.8 copper protoxide, 20 carbonic acid, and 8.2 water, and deriving its name, it is said, from the Greek, *malachè,* the marsh-mallow, in allusion to its colour. As an ore of copper, malachite occurs either foliated, fibrous, compact, or earthy; and usually in reniform, concretionary, or stalactitiform masses. The copper mines of Siberia and the Ural furnish the finest specimens, which, when cut and polished, are highly prized for ornamental purposes. Malachite seems, in many instances, to be a recent production, caused by the action of the water and carbonic acid of the atmosphere on other copper ores.

Malácolite.—Known also as *Sahlite;* a variety of augite of various shades of green, and of a vitreous or sub-pearly lustre.

Malacólogy (Gr. *malakos,* soft, and *logos,* discourse).—The science which treats of the mollusca—a term occasionally substituted for that of *Conchology,* as referring more immediately to the structure and functions of the animals, many of which are shell-less; while Conchology relates, on the other hand, more especially to the shell or mere external covering (*concha,* a shell) of those orders so provided.

Malacopterýgii (Gr. *malakos,* soft, and *pterygion,* winglet or fin).—One of Cuvier's primary divisions of Osseous Fishes, in which the fins are all soft or jointed. It is farther subdivided, according to the position or absence of the ventral fin, into—1. *M. abdominales,* in which the ventral fins are attached to the abdomen behind the pectorals (chiefly fresh-water species); 2. *M. sub-brachiati,* in which the ventral fins are brought forward under the pectorals (chiefly marine fishes); and, 3. *M. apoda,* in which the ventral fins are always wanting, and not unfrequently the pectoral also.

Malleable, Malleability (Lat. *malleus,* a hammer).—A property of many

metals, by which they are capable of being beaten out into thin plates or leaves by the hammer. Gold, silver, iron, copper, &c., are *malleable.*

Mallótus (Gr. *mallos,* a lock of wool).—The capelan, a small, soft-finned fish (whence the name) rather larger than a sprat, which inhabits the banks of Newfoundland, and other parts of the coasts of northern seas. Fossil specimens occur in nodules of indurated clay-marl on the coast of Greenland; but these are of very recent date, and, it may be said, still in the progress of formation.

Malm-Rock.—A local term for a calcareous sandstone which forms portions of the *Upper Greensand* in the counties of Surrey and Sussex. It is known also as "fire-stone."

Maltha.—A term occasionally applied to slaggy mineral pitch, as distinct from fluid *petroleum* on the one hand, and from solid *asphalt* on the other.

Mámmals, Mammália (Lat. *mamma,* a teat or pap).—The general term for all animals that give suck to their young. They constitute the first or highest class of VERTEBRATA, and are usually divided into *Placentalia* and *Implacentalia*—the former being those that are nourished previous to birth by a uterine network of blood-vessels called the *placenta,* and do not come into the world until they are provided with all their organs; the latter, those that are non-placental, or have no attachment to the uterus, and are brought forth in an imperfect state—the young being received into an external pouch (*marsupium*), and there nourished till their organs are matured. The non-placentals are comparatively few in number, are chiefly confined to the Australasian continent, and are regarded as lower in the scale of being than the placentals. Remains of marsupial mammals have been found in the triassic and oolitic rocks; the higher orders not till the Chalk and Tertiaries.—See tabulations, "Animal Scheme."

Mámmifers (Lat. *mamma*) a breast, and *fero,* I bear).—Literally "breast-bearing animals," or those which give suck to their young. Same as *mammals* and *mammalia.*

Mámmillary, Mammillated (Lat. *mamilla,* little pap).—Applied to surfaces covered with pap-like excrescences or concretions, as some magnesian limestones studded with rounded projections.—See BOTRYOIDAL.

Mammoth (Tartar).—The great fossil elephant of Siberia; the *Elephas primigenius* of scientific authors. Remains of the mammoth are found abundantly in many of the post-pliocene or Upper Tertiary deposits of northern Asia and Europe—the range of the animal being apparently between the 40th and 70th parallels of latitude, and its metropolis, according to Professor Owen, "the northern extreme of the temperate zone." The mammoth differs from existing elephants chiefly in its greater size, its dentition, which was fitted for milling coarser and less succulent vegetation, its immense recurved tusks, and its dense covering of shaggy hair, which fitted it for a cold and rigorous climate. Whole drifts of its tusks and bones are found in the northern ocean, and in the tundras and river-gravels of Siberia (*Von Wrangell*); and scattered tusks and bones are frequent in all the ancient alluvia of Northern Europe and the British Islands (*Owen's Fossil Mammals*).

Manátidæ (Lat. *manatus,* the sea-cow).—The *Sirenia* of some systematists; a family of aquatic herbivorous mammals, including the manatee, dugong, &c. Remains apparently of this family are occasionally found in pleistocene and ancient estuary-deposits.

Mánganese (Lat.)—A hard, brittle, greyish-white metal (somewhat re-

sembling iron) discovered by Gahn in the black oxide of manganese of commerce. Its specific gravity is about 8.; it is fused with great difficulty, but is readily oxidised. In an oxidised state manganese is abundant in the mineral kingdom, and traces of it have been found in the ashes of plants, and in mineral waters. The ores of manganese are erected by some mineralogists into a separate family, including such genera as *manganite,* or the grey oxide; *wad,* or the earthy protoxide; *cupreous manganese; pyrolusite,* or the dark peroxide; *psilomelane,* a compound of the peroxide and baryta; *Hausmannite, Braunite,* &c.—all described under their separate heads. The ores of manganese are largely used in the arts; as in glass-making; in pottery painting and glazing; in painting glass and enamel; in the production of oxygen, chlorine, and chloride of lime; and occasionally for an admixture for improving the make of iron and steel.

Mánganite.—Grey oxide of manganese, consisting, according to Turner, of 62.72 manganese, 27.18 oxygen, and 10.10 water. It occurs in veins in gneiss and other crystalline rocks, either in groups of prismatic crystals, or in radiating and columnar aggregates.

Mantéllia.—Considering the fossil cycadeoidea of the Isle of Portland as a peculiar type, M. Brongniart has referred them to a new genus under the name of *Mantellia,* in honour of the late Dr Mantell. These stems are of a sub-cylindrical shape, covered with rhomboidal leaf-scars, which are widest transversely, and are from one to two feet in height, and from one to three in circumference. They are termed "Crows' nests" by the quarrymen, who regard them as the nests of the former inhabitants of the now petrified forests of the Oolite.

Marble (Lat. *marmor*).—Any rock susceptible of a fine polish is termed "marble" by the stone-cutters; hence we hear of *Portsoy marble,* which is a true serpentine; of *Sicilian marble,* which is often a brecciated lava, and so forth. The term, however, should be, and is, restricted by geologists to limestones capable of receiving a polish, and frequently exhibiting a variety of colours. We have thus *uni-coloured* marbles, such as pure blacks or whites; and *particoloured* varieties, deriving their shades from accidental minerals, from metallic oxides giving them a veined and clouded appearance, or from shells, encrinites, corals, and other organisms which impart a variety of "figure" as well as of hue. Every country has its own peculiar marbles, and almost every age has had its own whims and fancies for certain varieties. The following are a few of the most esteemed varieties, ancient and modern:—*Carrara,* pure white, crystalline, and semi-transparent; highly esteemed for statuary purposes. *Parian,* of a waxy cream-colour, also crystalline, and employed in statuary. *Giallo-antico,* yellow and mixed with a small proportion of hydrate of iron; used for ornamental purposes. *Rosso-antico,* a deep blood-red, less or more veined. *Mandelato,* a light red, veined, and clouded. *Verde-antique,* a cloudy green mixed with serpentine. *Cipolin,* a mixture of talcose schist with white saccharoidal marble. *Lumachello* or *fire-marble,* a dark-brown variety, having brilliant chatoyant reflections which it owes to the nacreous matter of enclosed shells. *Black marbles,* like those of Derbyshire and Kilkenny, deriving their dark colours from bitumen. *Encrinal marbles,* like those of Derbyshire and other carboniferous districts, deriving their "figure" from the stems and joints of encrinites. *Shell marbles,* like those of Purbeck and Petworth in Dorset and Sussex, receiving their "figure" from the enclosed shells of various mollusca.

Margarite (Gr. *margarites,* a pearl).—One of the Mica family; known also as *pearl-mica,* or *hemiprismatic pearl-mica.* A pearly-grey mineral generally occurring with chlorite in scaly irregular masses, and rarely crystallised in six-sided tables.

Marl (Sax.)—Any soft admixture of clay and lime is termed a marl—"clay-marl" when the clay predominates; "marl-clay" when the lime is most abundant; and "shell-marl" when it contains fresh-water shells, as the *lymnea, paludina,* &c. In geological nomenclature we have "chalk-marls," "lias marlstone," and other appropriate enough terms; but occasionally the word is used to designate soft friable clays with which not a particle of lime is intermingled. For *Variegated Marls* or *Keuper,* see TRIASSIC SYSTEM.

Marlstone.—In geological classification, the middle member of the Lias formation, ranging in the eastern counties of England (York, Lincolnshire, &c.) from 100 to 150 feet in thickness, and consisting of arenaceous shales, laminated sandy limestones, and several bands of stratified and nodular limestone, the whole series being peculiarly rich in fossils—shells, corals, crustacea, and fishes. "The marlstone beds," says Phillips, "are in fact the first term of the oolitic deposits, interpolated among the last terms of the lias; and according as the clay above them is attenuated or developed, they may be ranked with the oolite or lias formation."

Mármolite (Gr. *marmaros,* shining like marble, and *lithos*).—A variety of foliated serpentine, of a pale-green, yellow, or light-grey colour.

Marsupiália, Marsupiáta (Lat. *marsupium,* a pouch or purse).—Literally "pouched animals;" an order of mammalia having a sack or pouch under the belly, in which they carry their young, as the kangaroo, wombat, and opossum. They are sometimes termed *ovo-viviparous* mammals, as being intermediate between the viviparous mammals and the oviparous birds and reptiles. For the same reason they are classed as *implacentalia,* in contradistinction to the true placental animals—the pouch-like apparatus for their imperfect young being a sort of extra-uterine gestation. Marsupial remains occur in the oolite and trias (*amphitherium, phaskalotherium,* &c.), and, according to American authority, even in the Permian (*dromatherium*), thus making them the earliest mammiferous creatures with which palæontologists are yet acquainted.—See tabulations, "Animal Scheme."

Mársupite (Lat. *marsupium,* a purse).—A genus of free-floating crinoidea found in the Chalk formation; having a bag-like shape when closed; and often known by the quarrymen's term "cluster-stones."—See CRINOIDEA.

Mássicot.—Yellow protoxide of lead. The dross that forms on melted lead exposed to a current of air, and roasted till it acquires a uniform yellow colour. Used as a pigment.

Massospondýlus (Gr. *masson,* longer, and *spondylos,* a vertebra).—A provisional genus of huge fossil saurians, occurring in the Triassic sandstones of South Africa; and so named by Professor Owen from the length of their vertebræ, the only remains yet discovered.

Mástodon (Gr. *mastos,* nipple, and *odous,* tooth).—A genus of Tertiary and Post-Tertiary elephantine mammals; so called from the nipple-like protuberances on the grinding-surfaces of their molar teeth. According to Falconer, who separates the *Mastodons* from the true *Elephants,* the genus includes "all the elephantoid species which have the crowns of the molars comparatively simple, and uniformly divided into two sub-equal divisions

by a longitudinal line or cleft; the ridges limited in number, each with fewer mammillary eminences, and invariably more or less concave across; the enamel thick, and in conical or compressed points; and the valleys between the ridges deep and empty, or with but a sparing quantity of cement." The same authority divides the genus into two sub-genera (*Trilophodon* and *Tetralophodon*), and enumerates upwards of a dozen species, which seem to have had a truly cosmopolitan range during the Pliocene and Post-pliocene periods.—See *Geological Journal*, vol. xiii.

Mastodonsáurus (Gr. *mastos*, a nipple, *odous*, tooth, and *sauros*, lizard). —A provisional genus of saurian reptiles occurring in triassic strata, and so called from the peculiar form of their teeth—the only portion of their remains yet discovered. Regarded by Owen as the same with LABYRINTHODON, which see.

Mátinal (Lat.)—Appertaining to the morning; the third of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian Chain—the "Morning" of the North American palæozoics, and the equivalents apparently of our Upper Cambrians.—See PALÆOZOIC FORMATIONS.

Matrix (Lat., the womb).—The rock or main substance in which any accidental crystal, mineral, or fossil is imbedded, is said to be the *matrix* of that mineral or fossil.

Meandrína (Lat.) — Brain-coral; madrepores in which the laminæ assume a meandering direction. The meandrinæ are large hemispherical corals having their surfaces covered with serpentine ridges and depressions, resembling the convolutions of the human brain. They occur abundantly in modern coral-reefs, but seem not to be represented in earlier formations.

Medína Sandstones.—An important group of North American Silurians which, taken in conjunction with the *Oneida Conglomerates*, are believed to be the representatives, in time, of the Lower Llandovery rocks of England—that is, the upper portion of the "Lower Silurian" division of Murchison.

Meerschaum (Ger., sea-scum; sea-foam).—A white, light, earthy carbonate of magnesia — the purer sorts consisting of 50 silica, 25 magnesia, and 25 water. It occurs among the serpentine rocks of several countries, but that used for the bowls of tobacco-pipes comes chiefly from Greece and Asia Minor. Being capable of forming a paste with water, it is sometimes spoken of as "plastic magnesia"—the commoner sorts being used in the manufacture of porcelain, and the finer (after undergoing various processes, such as boiling in milk, &c.) in the making of meerschaum pipes.

Megáceros Hibérnicus (Gr. *mega*, great, and *keras*, horn).—Literally, the "great antlered deer of Ireland." The fossil or sub-fossil gigantic deer of our pleistocene marls and peat-bogs, often, but erroneously, termed the "Irish Elk."—See IRISH DEER.

Megalíchthys (Gr. *megalè*, great, and *ichthys*, fish).—A large sauroid fish of the Carboniferous period, occurring most abundantly in the lower beds, and characterised by its smooth, enamelled, lozenge-shaped scales. The scales, jaws, and imperfect specimens which have been found in the Coal-measures of Fife and Mid-Lothian, indicate a fish of great size; but the teeth (which are numerous, sharp, and conical) are small in comparison with those of *holoptychius* and *rhizodus*, with which the remains of *megalichthys* are often confounded.

Megalónyx (Gr. *megalê*, great, and *onyx*, claw).—A huge edentate mammal, found chiefly in the upper tertiaries of America, and so called from the great size of its claw or unguical bones, the largest of which was about seven inches long. From the admirable inductions of Cuvier and others, it would appear that the Megalonyx somewhat resembled the Megatherium in its general character, configuration, and habits, but was a third smaller than that colossal animal.

Megalosaurus (Gr. *megalê*, great, and *sauros*, lizard).—One of the Dinosaurs, or gigantic land-saurians, whose teeth, vertebræ, femoral and other bones occur in the oolite and wealden strata. In these remains the character of the monitors seems blended with that of the crocodiles; and judging from its decidedly trenchant teeth, the Megalosaur was highly carnivorous, preying in all likelihood on smaller reptiles, and on the young of its gigantic contemporaries, the iguanodon and hylæosaurus.

Megaphýtum (Gr. *mega*, great, and *phyton*, a shoot).—A genus of Coal-measure stems, so called from the large size of their leaf-scars. In megaphytum the stem is not furrowed, but irregularly dotted or rugose; the leaf-scars large, horse-shoe shaped, and arranged on each side the stem in vertical rows. Allied to *Bothrodendron* and *Ulodendron*, and apparently coniferous.

Megathérium (Gr. *mega*, great, and *therion*, beast).—A huge edentate mammal whose remains occur abundantly in the upper tertiary or Pampean deposits of South America. In anatomical structure the Megatherium exhibits features intermediate between the Sloths, Armadilloes, and Ant-eaters; for while in its skull and shoulders it resembles the former, its legs and feet present an admixture of the characters of the latter. Larger than the largest rhinoceros, its length was about nine or ten feet; but its bones were proportionally much more colossal than those either of the rhinoceros or elephant. The structure of its teeth indicates herbivorous habits, and its powerfully-clawed fore-feet (about a yard in length) seem admirably formed for digging up the succulent roots and luxuriant herbage which would then adorn the fertile surface of the virgin Pampas.

Meionite (Gr. *meion*, less).—Prismatic-pyramidal felspar; so called from its terminating pyramids being *lower* than those of similar forms in the other minerals. Known also as *Wernerite* and *Scapolite*, which see.

Mélanite (Gr. *melas*, black).—A variety of iron garnet, so called from its black colour; and, according to Klaproth, consisting of 35.5 silica, 6 alumina, 26 iron peroxide, and 32.5 lime.—See GARNET.

Melánterite (Gr. *melas*, black).—The mineralogical term for the native *sulphate of iron*, which is a recent production from the decomposition of iron pyrites.

Méllite (Lat. *mel*, honey).—Honey-stone; mellitate of alumina; a rare mineral of a honey-yellow colour, resinous lustre, and more or less transparent, occurring in connection with Tertiary and Cretaceous lignites. According to Klaproth, it consists of 46 mellic acid, 16 alumina, and 38 water.

Ménilite.—A variety or sub-species of opaline quartz occurring in compact kidney-shaped nodules, in a bed of adhesive slate at Mont Menil near Paris; hence the name. It is sometimes known as "liver opal," from its brown colour, though varying shades of bluish-grey are not uncommon.

Mercury.—A well-known metal, which is always fluid at a temperature

higher than —39°; and hence, from its mobility and silvery lustre, usually called "*quicksilver.*" At temperatures less than —40° it becomes solid, and has a specific gravity of 15.6; when fluid, its gravity is only 13.5; under the blowpipe it is altogether volatile, or leaves a slight residuum of silver. It occurs in rocks of all ages, but is rarely found in a state of native purity—its more abundant ores being *cinnabar* or bi-sulphuret of mercury; *native amalgam,* an ore consisting of silver and mercury; and *calomel,* or chloride of mercury. The best-known mercury mines in Europe are those of Idria in Carniola, and Almaden in Spain. At Almaden the mercury is said not to form veins, but to have impregnated the vertical strata of quartzose sandstone associated with carbonaceous slates; and in the Asturias the mines are worked in coal strata.

Meridian (Lat.)—Mid-day; the eighth of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain—the "Mid-day" of the North American palæozoics, and the equivalents perhaps of our lowermost Devonians.—See PALÆOZOIC FORMATIONS.

Merycothérium (Gr. *meryko,* I ruminate, and *therion,* beast).—A huge ruminant found along with the mammoth and rhinoceros in the "drift" or upper tertiary beds of Siberia, and having affinity to the existing Bactrian camel.

Meso— (Gr. *mesos,* the middle).—A frequent prefix of scientific compounds, signifying intermediate, or that which holds a middle place between others.

Mesopithécus (Gr. *mesos,* intermediate, and *pithecos,* ape).—A generic term applied by Professor Wagner to the remains of a quadrumane discovered in the tertiary formations of Greece, and regarded by him as intermediate between the long-armed apes (*hylobates*) and the tailed monkeys (*semnopithecus*).

Mésotype (Gr. *mesos,* intermediate, and *typos,* form).—Prismatic Zeolite; a silicate of soda and alumina occurring abundantly in trap-rocks, and known also as *Natrolite,* which see.

Mesostylus.—The generic term for a small crustacean, whose cheliferous claws or pincers occur abundantly in the Chalk formation, and that without any vestige of carapace or body-crust. From this circumstance, as well as from the fact of the right claw always being the largest, it is presumed that the *Mesostylus* had the structure and habit of the living Hermit-crab (*Pagurus*)—viz., an abdomen unprotected by a calcareous crust, which it thrust for shelter into the shells of those molluscs with which its claws are now found associated.

Mesozóic (Gr. *mesos,* middle, and *zoê,* life).—The great division of stratified formations holding the middle forms of Life, as differing from the Palæozoic and Cainozoic. The mesozoic period thus embraces the Triassic, the Oolitic, and Cretaceous systems.

Metamórphic (Gr. *meta,* change, and *morphê,* form).—Literally "changed in form;" applied to rocks and rock-formations which seem changed from their original condition by some external or internal agency. In geological nomenclature the crystalline stratified rocks—Gneiss, Mica-schist, Clay-slate, &c.—are termed *Metamorphic,* and erected into a separate system. Strictly speaking, "metamorphic" applies to the power or force causing the change; "metamorphism," the process; and "metamorphosis," the result. Hence we ought to speak of *metamorphic* agency, and *metamorphosed* rocks.—See METAMORPHISM.

Metamorphic System.—Although the rocks of every formation may be, and to a great extent often are, subjected to mineral metamorphism, still in Geological Classification it is usual to restrict the term "Metamorphic System" to those crystalline schists—Gneiss, Quartz-rock, Mica-schist, and Clay-slate—which underlie all the fossiliferous strata, and in which no trace of organic remains has yet been detected. In grouping these schists it is often difficult to draw lines of distinction between them, and to say where the one ends or the other begins; still, on the whole, it may be received as a truth that Gneiss, or rocks of a gneissic character, occupy the lowest position in the metamorphic system; that these (at least in such typical districts as the Scottish Highlands) are succeeded by a zone of quartzitic compounds; and these again by mica-schists, which graduate imperceptibly into the chloritic and argillaceous slates that cap the series, thus:—

4. Clay-slate—chloritic and argillaceous slates.
3. Mica-schist—micaceous, talcose, and chloritic schists.
2. Quartz-rock—quartzitic compounds, generally thick-bedded.
1. Gneiss—gneiss-rock and granitoid schists.

The rocks composing these groups are less or more indurated and crystalline, have their lines of stratification indistinct, and often altogether obliterated, and, as sedimentary strata, have evidently undergone some peculiar change in their internal structure. This change, or metamorphism, whether produced by heat, pressure, or chemical agency, has conferred upon them the term of *Metamorphic rocks;* and by this designation they are now generally known among geologists. As strata, they are the deepest or lowest in the crust of the earth, and are therefore regarded as *Primary* or first-formed. They are also known as *Non-fossiliferous, Azoic,* or *Hypozoic* strata, from the fact that no distinct traces of plants or animals have yet been discovered in any part of the system.—See tabulations, "Geological Scheme."

Metamórphism (Gr. *meta,* change, and *morphè,* form).—Literally change of form, or transformation. That change of structure or of texture which has been effected on many rocks by the agency of heat, chemical action, or otherwise; as, for example, when chalk is converted into crystalline marble, or sandstone into jaspery quartz-rock. "The problem of metamorphism," we have elsewhere observed (*Advanced Text-Book*), "is altogether a difficult one, and one involving so many questions in the obscurer departments of chemistry, electricity, and crystallography, that geology must rest satisfied, in the mean time, with indicating rather than defining the nature of the operative causes. The most obvious and general of these may be briefly enumerated:—1. *Heat by contact,* as when any igneous mass, like lava, indurates, crystallises, or otherwise changes the strata over or through which it passes; 2. *Heat by transmission, conduction, or absorption,* which may also produce metamorphism, according to the temperature of the heated mass, the continuance of the heat, and the conducting powers of the strata affected; 3. *Heat by permeation of hot water, steam, and other vapours,* all of which, at great depths, may produce vast changes among the strata, when we recollect that steam, under sufficient pressure, may acquire the temperature of molten lava; 4. *Electric and galvanic currents* in the stratified crust, which may, as the experiments of Mr Fox and Mr Hunt suggest (passing galvanic currents through masses

of moistened pottery-clay), produce cleavage and semi-crystalline arrangement of particles; 5. *Chemical action and reaction,* which, both in the dry and moist way, are incessantly producing atomic change, and all the more readily when aided by an increasing temperature among the deeper-seated strata; 6. *Molecular arrangement by pressure and motion*—a silent but efficient agent of change, as yet little understood, but capable of producing curious alterations in internal structure, especially when accompanied by heat, as we daily see in the manufacture of the metals, glass, and earthenware. Such are the more general and likely causes of rock-metamorphism, and as it is possible that several of them may be operating at the same time, the student will perceive that no hypothesis that limits itself to any one agent can be accepted as sufficient and satisfactory. Heat and chemical action and pressure are, no doubt, the chief causes of change, and by them we can readily account for new crystalline arrangements in semi-fused masses, for *fissures, joints,* and *cleavage,* and in a great measure for that flexuring and folding of the stratified laminæ known as *foliation.* And if to these we add electricity, and new crystallographic and molecular arrangement under further chemical re-action, we call in a sufficiency of agency, though we may not always perceive the precise modes of action."

Méteorite (Gr. *meteoros,* raised above the earth).—A general term for any stone or mineral mass which has fallen through the atmosphere, and which, judging from its composition and other properties, does not seem to be of terrestrial origin. *Meteorites* or *meteoric stones* are perhaps better known by the term *aerolites,* which see.

Meyeria (after Von Meyer).—A small lobster-like crustacean, having its crust highly ornamented with minute bead-like tubercles, and occurring for the most part in the clays and marly beds of the Chalk formation.

Mica (Lat. *mico,* I glisten).—A mineral well known from its metallic lustre, and divisibility into thin glistening plates or scales—these ultimate laminæ, according to Haüy, being only $\frac{1}{250000}$ of an inch thick! It enters as a *primary* constituent into granite, gneiss, mica-schist, and other crystalline rocks; occurs also in several trappean and volcanic products; and is sometimes artificially produced on the walls of iron and copper furnaces. As a *secondary* product—derived from the disintegration of the granitic and crystalline rocks—it occurs in many sedimentary strata, as shales and sandstones, giving to them their flaky and laminated texture. In mineralogy it is made the type of a family, which includes the micas proper, talc, chlorite, serpentine, &c.—minerals often differing more in aspect than in chemical constitution. The typical *potash-mica* consists of silica, alumina, iron-peroxide, and potash; *lithia-mica* has less alumina with lithia and fluoric acid in addition; in *magnesia-mica* the alumina becomes still less, and is replaced by magnesia; while in *pearl-mica* the main constituents are silica, alumina, iron-peroxide, and lime. In the *chlorites* the silica becomes less, and is replaced by a greater per-centage of magnesia and iron; while in the softer and soapier *talcs* the alumina all but disappears, and is replaced by magnesia.

Micáceous.—Applied to rocks and compounds which are mainly composed of mica, or which contain mica in notable proportion; as "micaceous schistus," "micaceous sandstone," &c.

Mica-Schist (Gr. *schisma,* a splitting).—A metamorphic foliated rock composed of mica and quartz—the two ingredients occurring in alternate

folia with greater or less regularity. It is also, but improperly, known as "mica-slate"—the schistose structure of a *foliated* rock being very different from the platy *cleavage* of a true slate. As a ROCK, it passes through every stage of metamorphosis from that of a flaggy schist to a highly-crystalline compound almost undistinguishable from gneiss. As a GEOLOGICAL GROUP, the mica-schists hold an intermediate place in the Metamorphic System between Gneiss and Clay-slate, often passing into chloritic slate, and being associated with beds of quartzite, serpentine, and crystalline limestone.

Micráster (Gr. *mikron*, small, and *astron*, star).—A genus of *Spatangidæ* abounding in the Chalk, and so termed from the star-like arrangement of its small or incomplete ambulacral furrows. In *Micraster* the case is somewhat elongated, heart-shaped, and wider before than behind, with a sulcus or furrow in front. "The shell is fragile and composed of large polygonal plates; the tubercles small and irregularly distributed; the spines short. The mouth is transverse, situated anteriorly, and protected by a strong projection of the odd inter-ambulacrum, which is named the *lip*. The vent is terminal, and placed above the margin. There are but four ambulacra, and these are incomplete, comparatively of small extent, and situated in deep furrows."

Microléstes (Gr. *micros*, small, and *lestes*, beast of prey).—The generic term applied to a small insectivorous quadruped whose molar teeth and other remains were discovered in 1847 by Dr Plieninger in the bone-breccia of Würtemberg—a stratum which occurs among the upper beds of the Keuper, and occupying nearly the same place in the triassic system as the celebrated "bone-bed" of Aust and Axmouth.

Microphýta, Microphytes (Gr. *micron*, small, and *phyton*, plant).—Literally "minute vegetables;" a term applied to those microscopic forms usually known as DIATOMACEÆ, and which at one time were confounded with the INFUSORIA, or minute forms of animal life. It has been proposed by Dr Mantell to substitute the term *microphytal* for that of *infusorial*, where deposits are chiefly of vegetable origin, and not of animal; as was originally supposed by Ehrenberg, who regarded the "polishing-slate" of Bilin, the "berg-mahl" of Tuscany, and the "Richmond-earth" of Virginia, as of infusorial origin.

Microzóa (Gr. *mikron*, small, and *zoon*, animal).—A convenient term to denote minute animal organisms, whose forms can only be defined by the aid of the microscope, and this without reference to their exact place in zoological classification. The contradistinguishing term to *microphyta*, which refers to minute vegetable organisms.

Milíola.—A genus of minute foraminiferous shells, so called from their occurring in myriads in certain tertiary strata. The *miliolite Limestone*, which belongs to the "calcaire grossier" group of the Paris basin, is almost entirely made up of these many-chambered microscopic shells, and is the principal building-stone employed in the French capital.

Millepóra, Millepóridæ (Lat. *mille*, a thousand, and *pora*, a pore or passage).—Literally "Thousand-pore;" a genus and family of branching corals, whose cells or pores are minute, distinct, and perpendicular to the surface, giving to the interior a finely striated fracture, disposed somewhat irregularly. Species of Millepores occur fossil from the Silurian upwards.

Millstone Grit.—A group of the English carboniferous system, so called from its hard gritty sandstones being extensively used for millstones. In

the eastern and northern counties the *Millstone Grit* immediately underlies the true Coal-measures, and passes downwards through a series of thick-bedded sandstones, shales, thin coals, and calcareous bands, into the Carboniferous Limestone below.

Mimosítes.—The term applied to fossil seed-pods apparently belonging to plants of the *Mimosa* family. They occur in the London Clay, and in other tertiary strata.

Mine.—The familiar as well as technical term for any system of subterranean work or excavation which has for its object the discovery and extraction of the metallic ores or other mineral produce, as coal, rock-salt, &c.—**Mining,** the art or systematic management of a mine in all that relates to winning, draining, ventilating, and the like.

Mineral.—Literally, any substance obtained from the Earth's crust by *mining* or digging. The term, however, is used adjectively as well as substantively; hence we speak of the "mineral kingdom" in contradistinction to the animal and vegetable kingdoms, and in this sense it is equivalent to *inorganic* as contrasted with *organic.* We also speak of "mineral oil" in contradistinction to animal or vegetable oil; and of "mineral green" as distinguished from vegetable green. Substantively a MINERAL is regarded as an inorganic substance, the product of chemical or physical forces, in contradistinction to substances resulting from the operations of vitality; and yet coral-reefs and shell-beds, peat-mosses and coal-seams, become "minerals" when entering into the composition of the Earth's crust. In the stricter language of Mineralogy, a "*mineral species*" is a substance whose form, chemical composition, and physical properties, are sufficiently uniform and persistent as to permit of identification, as diamond, rock-crystal, garnet, and so forth. In this sense also Geologists speak of "*simple minerals*"—meaning thereby the primary constituents of rock-masses. Thus ordinary granite, as a compound rock, consists of the simple minerals, quartz, felspar, and mica, though, chemically speaking, each of these is composed of several elementary ingredients.

Mineralisation. — The process of converting any substance into a mineral; as vegetable matter into coal, animal fibre into adipocere, or a metal into an oxide, sulphuret, or other ore. Mineralisation is strictly dependent on chemical changes, brought about by the natural action and reaction of substances one upon another, when placed in conditions favourable to such reactions.

Mineralogy.—Literally "the science of minerals;" that branch of knowledge which investigates the qualities of, describes, and classifies the various mineral substances which enter into the composition of the crust of the globe. In describing and classifying minerals we may be guided either by their chemical composition, by their crystallographic forms, or simply by their physical properties of colour, lustre, hardness, fracture, and so forth; hence we hear of the "*system*" of this author, and the "*system*" of that, according as they may have adopted one or other of these methods of discrimination. As yet the science of Mineralogy, notwithstanding the sound progress which has been made of recent years, is in a very unsatisfactory state—cumbered by synonymes, overloaded with subdivisions into so-called "species," and devoid of that unity of nomenclature which makes the terms employed express a portion of the information attempted to be conveyed.—See CRYSTALLOGRAPHY.

Mineral Caoutchouc.—Known also as *elaterite,* or elastic mineral pitch;

a variety of bitumen resembling caoutchouc in elasticity and softness.—See ELATERITE.

Mineral Charcoal.—This term is usually applied to those silky fibrous layers of charcoal, which are interlaminated in beds of ordinary bituminous coal, and which give to it its staining or blackening properties. These layers seem to have arisen from some process of spontaneous combustion during the mineralisation of the vegetable mass, whereby their volatile products have been expelled, and the carbon of the ligneous fibre left behind.

Mineral Tallow.—A familiar term for *Hatchetine,* in allusion to its fatty or spermaceti-like appearance.—See HATCHETINE.

Miocene (Gr. *mein,* less, and *kainos,* recent).—Sir Charles Lyell's term for the middle tertiaries, as holding *a less* per-centage of recent shells than the pliocene or upper tertiaries. In 1830, when the terms were introduced, the per-centages were, *pliocene,* 35 to 50 ; *miocene,* 17 ; and *eocene,* $3\frac{1}{2}$.—See TERTIARY SYSTEM.

Mocha Stone.—A variety of dendritic or moss-agate, so called from its being found in abundance near Mocha in Arabia. The dendritic lines and patches, being of a dark colour, are finely shown off in the glassy translucent matrix of the Agate.—See AGATE.

Modíola (Lat. *modiolus,* a small measure).—A genus of bivalves belonging to the family Mytilidæ, but distinguished from the mussels by their habit of burrowing or spinning a nest. The living species are chiefly tropical ; the fossil occur in all formations from the Silurian (?) upwards. The name has reference to the shape of the shell, which is oblong and inflated in front.

Molar (Lat. *mola,* a mill).—The molar or grinding-teeth of mammals so termed from their function of milling or grinding the food before it is fit to be swallowed. The shape of the molars differs in the different tribes of animals according to the nature of the food they consume, and the kind of work they have accordingly to perform. Thus in the carnivorous or flesh-feeding tribes they are raised into sharp prongs, and often serrated edges, for cutting ; in the insectivora they are furnished with rounded tubercles for bruising and pounding ; and in the graminivorous and herbivorous races they have flattened surfaces more or less rough for the purpose of simply grinding or milling. These distinctions afford important aid to the discriminations of the palæontologist.—See ODONTOLOGY.

Molasse (Lat. *mollis,* soft).—A provincial term for those soft arenaceous beds which constitute the middle tertiaries of Switzerland. This deposit, occasionally alternating with lignite, but generally composed of loose greenish sand, is thickly developed in the great Swiss valley, and spreads also over large tracts in France, overlying the other and better-known tertiaries. It is partly marine, and partly of fresh-water origin.

Molecular Attraction.—In Natural Philosophy, that force or attraction by which the particles or molecules of bodies are kept together *en masse,* as distinguished from the attraction or force of gravitation. "According to the molecular theory," says Hoblyn, "all bodies are viewed as aggregates of minute particles or molecules, and are formed by the attractive and repulsive forces acting on these molecules at immeasurably small distances."

Molecule (diminutive of *moles,* a mass).—Any minute particle of matter ;

the ultimate visible particles of which any body or mass is composed, are usually termed *molecules.*

Mollusca (Lat. *mollis,* soft).—One of Cuvier's grand divisions of the Animal Kingdom, including all the "shell-fish" proper, and having reference to the circumstance that these creatures have *soft* bodies, unsupported by any internal or tegumentary framework of sufficient density to merit the name of skeleton. The term has been much objected to, but the words *mollusc, mollusca,* and *molluscous,* are now too thoroughly incorporated with the language of zoology and palæontology to be readily abandoned. Since Cuvier's time the meaning of the term has undergone some modification, and it is now common to speak of the MOLLUSCA and the MOLLUSCOIDA—the former embracing the "shell-fish" proper; the latter, those which have only coriaceous or horny integuments: thus—

MOLLUSCA.	Cephalopoda—cuttle-fish, calamary, nautilus. Pteropoda—hyalæa, clio. Gasteropoda—snails, slugs, whelks, cowries. Acephala—oysters, mussels, shipworms. Brachiopoda—terebratula, lingula.
MOLLUSCOIDA.	Tunicata—biphora, simple and compound ascideans. Polyzoa or Bryozoa—plumatella, flustra, eschara.

The shells and frameworks of most of the mollusca being calcareous and readily preserved, and each family having its own habitat as to depth, nature of sea-bottom, and the like, their remains become important aids to the geologist in the solution of his problems.—See tabulations, "Animal Scheme."

Mollúskite.—A dark-brown carbonaceous substance occurring in shelly marbles, and originating from the mineral transmutation of the soft bodies of the mollusca. Speaking of the Sussex marble, which is chiefly composed of paludinæ (river-snails), Dr Mantell observes—"Those shells which were empty at the period of their becoming imbedded had their cavities filled with mud, silt, or other detritus, which has subsequently hardened into clay, marl, limestone, &c.; but those which contained the gelatinous bodies of the snails are occupied by a mass consisting of carbon and a large proportion of phosphate of lime. In the polished sections of the marble, this carbonaceous animal matter often appears in black or dark-brown spots and veins; and the most beautiful slabs owe their variegated appearance to the contrast produced by the *molluskite* with the white calcareous spar."

Molýbdenite.—Sulphuret of molybdenum; molybdena-glance; an ore found in various rocks, as granite, gneiss, and chlorite slate, and in veins with tin and other ores. It much resembles graphite, but is readily distinguished by its streak, lustre, and action before the blowpipe. It is used for preparing a blue pigment for pottery ware.

Molybdenum (Gr. *molybdos,* lead).—A very rare metal discovered by Hielm in 1782, of a whitish colour, brittle, very infusible, and having a specific gravity of 8.625. It derives its name from the resemblance of the native sulphuret (*molybdenite*) to that of lead.

Mon—, Mono— (Gr. *monos,* single).—A common prefix derived from the Greek, and signifying singleness or unity; as *mono-lith,* a monument composed of a single stone; *mono-ceras,* having one horn; *mono-cotyledonous,* possessed of a single cotyledon or seed-lobe.

Monad (Gr. *monas,* an atom).—The smallest of all visible animalcules, and

sometimes spoken of as constituting "the ultimate term of animality." According to Ehrenberg, monads have an average diameter of not more than 24,000th of an inch, so that 500,000,000 of them might be contained in a single drop of water.

Monoclínal (Gr. *monos*, single, and *klino*, I bend).—Applied to strata that dip for an indefinite or unknown length in one direction, and which do not apparently form sides of ascertained *anticlines* or *synclines*. Monoclinal strata often form series of hills—the abrupt outcrops constituting ridges which follow each other like the teeth of a saw.

Monocotyledonous (Gr. *monos*, one, and *cotyledon*, seed-lobe).—A grand division of the vegetable kingdom, comprising all those plants whose seeds have only one lobe or seed-leaf. They are *endogenous* in growth, or increase from within like the palms, lilies, grasses, &c., and are characterised by a parallel venation of the leaves.—See tabulations, "Vegetable Scheme."

Monográpsus (Gr. *monos*, single, and *grapho*, I write).—A term proposed by Geinitz to embrace all those graptolites with a single row of teeth-like cells, as *rastrites*, *graptolithus*, &c., which see.

Monolith (Gr. *monos*, single, alone, and *lithos*).—A pillar, obelisk, or other monument, consisting of a single stone. Many of the Egyptian monuments were of this *monolithic* character.

Monomyária (Gr. *monos*, single, and *mus*, a muscle).—A term employed by Lamarck to distinguish those bivalves whose shell is closed by a single adductor muscle, in contradistinction to the *dimyaria*, or those having a second adductor. The monomyaries are the oysters, aviculidæ, and clam-shells.

Monopríon (Gr. *monos*, alone, single, and *prion*, a saw).—Barrande's term for the common graptolite, its toothleted cells being arranged, like the teeth of a saw, all on one side.

Monte Bolca, near Verona, in Italy; a locality celebrated for its fossil fishes, which are found in a fissile, cream-coloured limestone of Upper Tertiary age—the deep-brown, semi-bituminous colour of the organisms contrasting finely with the lighter hue of the matrix. According to Agassiz, the species, though related to those still existing, are all extinct; and from the immense numbers imbedded in so limited an area, it is conjectured that the limestone had been erupted as a calcareous mud by volcanic agency, and thus suddenly suffocated the fishes within its influence.

Moonstone.—A fine variety of adularia felspar, so called from the pale-bluish opalescence it exhibits when cut *en cabochon*. The rough mineral is said to constitute the famous *petuntse* or vitrifying ingredient of the Chinese porcelain.

Moraines.—The name given in Switzerland to the longitudinal mounds of stony detritus which occur at the bases and along the edges of all the great glaciers. The formation of these accumulations is thus explained by Professor Agassiz:—The glaciers, it is well known, are continually moving downwards, in consequence, probably, of the introduction of water into their fissures, which, in freezing, expands the ice; and the ice being thus loosened or detached from the rocks on which it rests, is gradually pressed forward by its own weight. In consequence of this motion, the gravel and fragments of rocks, which fall upon the glaciers from the sides of the adjacent mountains, are accumulated in longitudinal ridges or *moraines* as the glacier melts away. There are thus two sets of moraines, viz., "lateral" and "terminal," the former flanking the margins of the glacier in its down-

ward course in *long narrow spits,* the latter occurring in *mounds* at the free edge or terminus that projects into the valley below. As the terminus advances and retreats according to the nature of the seasons, there will often be several terminal moraines; and this disposition of gravel-mounds is very observable in all mountainous regions, either now or during former epochs, the theatres of glacial phenomena.—See GLACIER.

Mortar.—The term applied by builders to the well-known admixture of slaked lime and siliceous sand, with which they cement or bind together the stones and bricks of their buildings. Like other hydrates of lime, mortar, if well prepared, "sets" readily, and acquires great hardness and durability.

Mosæsáurus.—A gigantic marine reptile of the Upper Chalk, apparently intermediate between the monitors and iguanas; and so called from its being first found in the Maestricht beds. The jaw of the Maestricht animal is 3 feet 9 inches long, and the entire length of the skeleton is estimated at 24 feet—the head being thus about one-sixth of the whole length. In this respect it resembles the crocodiles more than the monitors; but in the shortness of the tail it is altogether unlike the crocodiles and alligators. Its extremities are imperfectly known, but those attributed to the *mosæsaurus* would indicate swimming rather than progression on land; hence the inference of its marine nature.

Moss Agate.—A variety of agate which, on being cut and polished, exhibits numerous minute branchings like the filaments of moss; hence the name.—See AGATE.

Mountain.—In Physical Geography, any portion of the earth's crust rising considerably above the surrounding surface. The term is usually applied to heights of more than 2000 feet, all beneath that amount being regarded as *hills,* and when of inconsiderable height, as *hillocks.* A *Mountain-Chain* or *mountain-range* is a series of elevations having their bases in contact, and their axis continuous over a considerable extent of country, as the Grampians, Urals, Himalayas, &c. Their summits are distinguished by such terms as *cones* when gradually tapering to a point; *domes,* when more massive and rounded; *peaks,* when abrupt and insulated; and *needles* or *aiguilles,* when still more pointed and detached. As mountain-ranges exercise very decided influences on the natural history of the globe, and as they extend in directions more or less definite, various theories have been advanced to account for their upheaval, their parallelism and geographical connection, and also to determine their age or relative antiquity. Thus, as their central masses generally consist of igneous rocks which have been protruded from below, and as this protruding force must have acted along the line of least resistance, the question arises, What is the determining cause of these directions? According to Elie de Beaumont, every system of mountains occupies a portion of a great circle of the globe—the cleft being more easily made in that than in any other direction; and he shows that the mountain-chains of the same age are parallel to one another, even when in opposite hemispheres. Mr Hopkins, treating the subject from a purely mathematical point of view, has also shown that when the upheaving force acts on a single point, the lines of upheaval must radiate from that point; hence lofty central mountains with diverging spurs. He also shows that when the expansive force acts uniformly over a wide area, the lines of greatest tension or upheaval must be in the direction either of the length or breadth

of the area, and that if the crust yields in more places than one, the fissures would necessarily be parallel. Proceeding upon these views, the various mountains of the world have been so far arranged into "Systems;" and their relative antiquities determined partly by these means, and partly by the stratified rocks which had been broken through, and which now flank their declivities. Of course this uniformity of system has been considerably obscured, if not modified, by subsequent geological changes; and we can only accept such generalisations as initiatory steps towards the elucidation of one of the most important problems connected with the history of our globe.

Mountain Blue and **Mountain Green.**—Familiar terms for the blue and green carbonates of copper; the epithet "mountain" being at one time very much used as synonymous with "mineral."

Mountain Cork, &c.—Asbestos, as it occurs in veins and crevices, often assumes very curious appearances; hence the light elastic variety is known as *mountain-cork;* the tough variety as *mountain-leather;* the woody fibrous-looking variety as *mountain-wood;* and when it occurs in thin papery pieces, it is known as *mountain-paper.*—See ASBESTOS.

Mountain Limestone.—An early, and still used, term for the *Carboniferous Limestone,* from its being frequently thrown up in thick bluffs or scars on the flanks of such hills as those of Yorkshire and Derbyshire; and in contradistinction to the comparatively low-lying strata of the Lias and Oolite limestones.—See CARBONIFEROUS SYSTEM.

Mountain-Soap.—A variety of soapstone or silicate of magnesia found in the Isle of Skye, and used in crayon drawing.

Mountain Tallow.—Another name for *mineral tallow,* or *Hatchetine* (which see); terms which include several waxy or tallow-like mineral substances, concerning whose nature and origin very little is yet known.

Moya (Span.)—A term applied in South America to the fetid sulphurous mud discharged by certain volcanoes; the *Koth* of the natives.

Mudstone.—A term originally applied by Sir R. Murchison to certain dark-grey, fine-grained, shivery shales of the Silurian system in Wales, which, on being exposed to the atmosphere, are rapidly decomposed and converted into their primitive state of mud; but now extended to all similar shales in whatever formation they may occur.

Muller's Glass.—Another name for glassy opal, or *hyalite,* which see.

Murchisónia (after Sir R. Murchison).—An elongated spiral shell, having the outer lip deeply notched, as in the *Pleurotomaria.* Of Murchisonia (family *Haliotidæ*) about fifty species have been enumerated, and these occur in the Silurian, Devonian, Carboniferous, and Permian formations.

Múrchisonite (after Sir R. Murchison).—A golden or greyish-yellow variety of felspar from the granite of Arran, and from the new red sandstone conglomerate of Dawlish in Devonshire.

Múriacite or **Muriazit.**—A term usually applied to the crystalline varieties of anhydrous sulphate of lime, or *anhydrite,* which also occurs in granular, fibrous, compact, and fibro-compact masses.—See ANHYDRITE.

Muriate (Lat. *muria,* brine).—Muriates are salts formed by the combination of muriatic or hydrochloric acid with a base, as *muriate of soda, muriate of iron,* &c.

Muriátic Acid (*muria,* brine).—Known also as *hydrochloric acid;* an acid consisting of chlorine and hydrogen, and occurring abundantly in sea-

water, in combination with soda and magnesia—common salt being a "muriate of soda."

Muricálcite (*muria,* brine, bitterness; and *calx,* lime).—Another name for *rhomb-spar* or *bitter-spar* (which see); a mineral consisting of the carbonates of lime and magnesia.

Múridæ (Lat. *mus, muris,* a mouse).—The Rat family; a well-known tribe of Rodents, including the mice, rats, water-voles, &c. Their remains are found in the bone-caves and deposits of the Pleistocene epoch.

Múriform (Lat. *murus,* a wall, and *forma,* likeness).—Wall-like; a term applied to tissues and organic structures presenting the appearance of bricks in a wall; *e.g.,* the *muriform tissue* which constitutes the medullary rays in plants.

Múschelkalk (Ger.)—Literally "shell-limestone;" the middle member of the Triassic system as it occurs in Germany—the Trias consisting of the *Keuper, Muschelkalk,* and *Bunter-sandstein.* The muschelkalk is wanting in England, but constitutes the *calcaire coquillier,* the *calcaire à ceratites,* or the *terrain conchylien* of French geologists. In Germany it consists chiefly of a compact greyish limestone, but includes beds of dolomite in many places, together with gypsum and rock-salt. It is rich in fossil shells, as the name implies—the *ceratite, posidonia,* and *avicula* being the prevailing forms.—See TRIASSIC SYSTEM.

Muscítes (Lat. *muscus,* moss).—A general term for fossil plants of the Moss family, which as yet have been found only in amber, and in certain fresh-water Tertiary strata.

Múscovy Glass.—A familiar term for *Mica,* most of the large plates used in the arts being brought from Eastern Russia, where they are employed as a substitute for glass.

Mussel-Bind or **Mussel-Band.**—A miner's term for thin shelly bands, calcareous and ferruginous, that occur in the coal-measures. They are almost entirely composed of shells resembling the existing fresh-water mussels, the *anodon* and *unio.*

Mýadæ or **Myácidæ** (Gr. *myax,* the gaping mussel).—A family of conchiferous molluscs, generally known as the Gaping Bivalves, named from the genus *mya,* and having the valves less or more gaping at one or both extremities. It includes the *mya, corbula, neæra, thetis, panopæa, saxicava,* &c., many species of which are fossil as well as recent.

Myliobátis (Gr. *mylias,* a mill-stone, and *batis,* the thorn-back, a species of skate or ray, from *batia,* a bramble).—A genus of rays (the *Eagle-rays*) characterised by the extraordinary development of the median teeth in both jaws. Instead of pointed teeth, they have wide, flat, tesselated dentary plates in each jaw, composed of distinct pieces, juxtaposed and connected by their margins, and united by fine sutures. These "milling" or "grinding" teeth occur abundantly in Tertiary strata—about twenty species having been found in the isle of Sheppey, &c., while only five species of existing *Myliobates* are known.

Mýlodon (Gr. *mylos,* a mill, and *odous,* tooth).—A gigantic edentate animal from the Upper Tertiaries of America, and so called in allusion to the flat grinding surfaces of its molar teeth. There is a skeleton of the Mylodon in the Hunterian Museum, London, almost as perfect as if the animal had been but recently buried, and its bones dug up entire. It is eleven feet long from the muzzle to the extremity of the tail; thus indicating a size as large as that of the hippopotamus, with the bones more

than proportionately massive. The Mylodon, like the Megatherium, was a vegetable feeder; and from the conformation of its fore feet and arms, which are fitted for grasping and wrenching, as well as that of its hinder extremities and strong thick tail, which seem adapted for supporting the body in an upright position, it is supposed that it sat in this position stripping the trees of their leaves and succulent branches.—See *Owen's Memoir on the Hunterian Skeleton*, published in 1842.

Myriacánthus (Gr. *myria*, innumerable, and *acantha*, a thorn or spine).—Literally "many-spined;" a genus of fossil rays whose ichthyodorulites, or serrated spines, occur abundantly in the Lias formation of England.

Myriápoda (Gr. *myria*, innumerable, and *pous*, *podos*, foot).—An order of articulate or annulose animals, including the centipedes and millepedes, and represented by the *scolopendra* and *julus*. They are so called from the numerous segments of the body being each provided with one or more pairs of jointed ambulatory feet.

Myriophyllítes (Gr. *myria*, innumerable, and *phyllon*, leaf).—Coal-measure stems, or rather *roots*, surrounded, as the name implies, with numerous fibres. Regarded by Lindley as "aquatic plant roots," though by others ranked as having affinity with *Halorageæ*.

Myripristis (Gr. *myrioi*, many, and *pristis*, sawing).—A genus of fossil fishes of the Perch family occurring in the London clay, and so called from their peculiar dentition.

Mytiláceæ (Lat. *mytilus*, the sea-mussel).—The Mussel tribe; also known as the MYTILIDÆ or mussel-family—an extensive group of conchiferous molluscs, including the genera *mytilus*, *myalina*, *modiola*, *lithodomus*, *crenella*, &c., many species of which are fossil as well as recent. Their shells are equivalve, oval or elongated, closed, umbones anterior, furnished with a thick epidermis, more or less pearly within, and have the hinge edentulous. Shells undetermined, but, approaching in form to that of the *mytilus* or common mussel, are said to be *mytiloid*.

N

Nácreous (Fr. *nacre*, mother-of-pearl).—Applied to shells and minerals which have a pearly or iridescent lustre like mother-of-pearl. The nacreous portion of some shells (the ammonite, for example) is still preserved in a fossil state.

Nácrite (Fr. *nacre*, mother-of-pearl).—A mineral of the Mica family having a pearly lustre, massive, and of a fine scaly texture. When rubbed between the fingers it leaves a pearly gloss. *Talcite*, *earthy-talc*, and *phollerite*, are occasional synonyms. Consists of 41.78 silica, 43.10 alumina, and 15.12 water.

Nagelflue or **Nagelfluhe** (Ger.)—A provincial Swiss term for a soft arenaceo-calcareous conglomerate, occurring among the middle or miocene tertiaries of the Alps, and said to derive its name from the enclosed pebbles appearing like swarms (*fluge*) of nail-heads (*nägel*) in the mass. It is termed *gompholite* or nail-stone by Brongniart, and sometimes attains the

truly wonderful thickness of 6000 or 8000 feet, as in the Rigi near Lucerne, and in the Speer near Woren.

Nágyagite.—Foliated Tellurium; a mineral consisting of tellurium and lead, with traces of gold, silver, copper, and sulphur. So called by Haidinger from its occurring in veins with gold and other ores at Nagyag in the Siebenberg.

Naiades (*Naïas*, a water-nymph).—The fresh-water mussels or UNIONIDÆ, which see.

Naker Feldspar.—Pearly felspar; a mineralogical term somewhat loosely applied to varieties of adularia, moonstone, avanturine, and other pearly felspars.

Náphtha.—A variety of bitumen (which see), thin, volatile, fluid, and highly inflammable. Springs of it exist in many volcanic countries—the finest variety being obtained from the shores of the Caspian, where it rises from calcareous rocks in the state of an odorous inflammable vapour. Naturally it is of a yellowish colour, but may be rendered colourless by distillation. Its specific gravity is about .75; it boils at 160°; and appears to be a pure hydro-carbon—100 parts consisting of about 83 carbon and 15 hydrogen. Most of the naphtha of commerce is obtained by distillation from coal-tar, or directly from coal. Used largely as a solvent for caoutchouc.

Náphthaline.—A soft, greyish white, flaky-crystalline substance found incrusting the pipes during the rectification of coal-tar. It also occurs in a native state associated with certain coals and lignites. It is a hydro-carbon, consisting of 60 carbon and 40 hydrogen; has a peculiar aromatic odour; is extremely volatile, fusing at 180°; burns with much smoke; and dissolves in alcohol and ether.

Natatóres, Natatórial (Lat. *nato*, I swim).—In Ornithology, the swimming or natatorial order of birds, readily distinguished by their oar-like, webbed or partially-webbed feet. The order includes the ducks, gulls, pelicans, divers, and penguins.

Natícidæ.—Sea-snails; a family of carnivorous gasteropods, named from the genus *natica*, which has been taken as the type of the family. The *Naticidæ* occur fossil in all formations from the Silurian upwards; the existing genera are also widely distributed. The naticæ frequent sandy and gravelly bottoms, ranging from low-water to 90 fathoms.

Nátrolite.—Prismatic zeolite or mesotype, occurring in many varieties of trap-rock, either in veins, drusy cavities, or disseminated. Derives its name from the amount of soda it contains. According to Thomson, a specimen from Antrim consisted of 48 silica, 25 alumina, 16 soda, 10 water, and traces of potash, lime, and iron peroxide.

Nátron (*natrium*, an early chemical term for sodium).—Natron is a native carbonate of soda, occurring in solution in the waters of many springs and salt lakes (Egypt); as a crystalline crust on the beds of dried-up lakes, in deserted river-courses, and on certain alluvial plains (South America); as a pulverulent efflorescence on the ground, as in the plain of Debreczin in Hungary; and as a product of decomposition in many lavas, traps, and other volcanic rocks.

Nautílidæ.—A well-known family of tetrabranch cephalopods, of which the *nautilus* has been taken as the type. It includes the genera *nautilus, lituites, trochoceras,* and *clymenia,* which see. Of the existing nautilus there are only three or four species found in Indian seas, while the fossil

species exceed 100. "In the recent nautilus," remarks Dr Buckland, "the shell is smooth, but in many fossil species it is arranged like the patent iron-roofing, so remarkable for its strength and lightness."—See CEPHALOPODA, and tabulations, "Animal Scheme."

Nautilítes.—A general term for fossil shells apparently allied to the existing nautilus. They are found in all formations from the Silurian upwards, but are now represented by three or four species only. They are distinguished from the ammonites by their central siphuncle, simple sutures, and fewer whorls.

Navícula (Lat., a little boat).—A genus of Diatoms or microscopic plant-growths, so called from their siliceous boat-like cases, which are perforated by six transverse slits, and in many species exquisitely ornamented. They are free floaters, and seem to move by ciliary action; abound in existing waters, as well as in many post-tertiary and tertiary strata.

Nébular Theory (Lat. *nebulæ,* thin filmy clouds).—A theory or hypothesis often referred to in speculative Geology. In the primal condition of the solar system, it is supposed that the sun was the centre or nucleus of a *nebulosity* or *luminous mass,* which revolved on its axis, and extended far beyond the orbit of the most distant of the planets—these bodies then having no existence. The temperature gradually diminishing, and the nebula contracting by refrigeration, the rotation increased in rapidity, and zones of nebulosity were successively thrown off in consequence of the centrifugal force overpowering the central attraction. These zones, being condensed, and partaking of the primary rotation, constituted the planets, some of which in turn threw off zones which now form their satellites. In this way the formation of the Solar group is accounted for—a view which the nebulists attempt to support by certain appearances in space (*nebulæ* and *nebulous clusters*) which present themselves to the telescope of the astronomer.

Nécrolite (Gr. *nekros,* dead, and *lithos,* stone).—A term applied to certain nodules in limestone strata, such as those of Baltimore, U.S., which when struck exhale a fetid odour, like that of putrid flesh. Concentrated nodules of fetid limestone or *stinkstein,* which see.

Nemacánthus (Gr. *nemo,* to scatter, and *acantha,* spine).—A genus of oolitic ichthyodorulites or ray-spines, so called from their being covered with minute denticles or prickles, and supposed to belong to the cestraciont fish CERATODUS, which see.

Neocómian.—A term of d'Orbigny's for the greensand or lower cretaceous formation, which is specially developed in the vicinity of Neufchatel (Neocomum). The term is now very generally used by English and American geologists, some of whom (considering the intimate relation of the Lower Greensand and Wealden fossils) arrange the Wealden as "Lower Neocomian."—See tabulations, "Geological Scheme."

Néogene (Gr. *neos,* new, and *ginomai,* I am formed).—The Pliocene and Miocene tertiaries are grouped together by some Continental geologists under the term Neogene (*new-born*), in contradistinction to the decidedly older strata of the Eocene.

Neozóic (Gr. *neos,* new, and *zoē,* life).—Arranging the fossiliferous strata into two great categories—the *palæozoic* and *neozoic,*—the former includes all up to the close of the Permian, the latter all from the commencement of the Trias up to the existing order of things. It thus embraces the

mesozoic and cainozoic of some palæontologists.—See tabulations, "Geological Scheme."

Népheline (Gr. *nephelê*, a cloud).—A double silicate of alumina and soda occurring in small crystals in the igneous rocks (imbedded or in druses), and so termed from its transparent fragments becoming *cloudy* in nitric acid. Closely related to or identical with *elæolite*—the nephelines being more or less transparent, of vitreous lustre, and colourless or white, whereas the elæolites are more opaque, of resinous lustre, and generally of reddish-brown hues. Nepheline is also less fusible than elæolite. Being found in ejected blocks on Monte Somma, Vesuvius, it is sometimes known as *Sommite*.

Néphrite (Gr. *nephros*, a kidney). —A technical term for the tough siliceo-magnesian mineral better known as *Jade*, which see. Formerly little plates of it were suspended from the neck as a charm in the case of *nephritic* or kidney complaints; hence the name.

Neptúnian (*Neptunus*, god of the sea).—Applied to stratified rocks, or to those deposited in, and by the agency of water (aqueous), in contradistinction to *Plutonic* or igneous.

Nereites.—Long, sinuous, annulated tracks and impressions occurring on Silurian and other strata, and from their numerous segments and cirrhated or tentacled feet, apparently allied to the existing *Nereidæ* or Sea-centipedes. The living family includes some elongated and distinctly annulated worms, which possess a well-developed head, furnished with tentacles and eyes, and a mouth with a proboscis which is sometimes unarmed, and sometimes furnished with three or four feet. The cirri or tentacles attached to the feet are often of considerable length, and in some species are even annulated. Many of the fossil impressions present analogous characters, hence their presumed affinities to annelids of the Dorsibranchiate order (*Errantia*); but in others the characters are not so obvious, and it has been suggested by M. Geinitz that not a few of the so-called *Nereites* may be soft and fleshy forms of Graptolithina.

Nereográpsus.—A term applied by M. Geinitz to many of the Silurian organisms known as *Nereites*, from the belief that they were soft-stemmed creatures like the graptolites, and not annelids resembling the existing *nereis*.

Neuróptera (Gr. *neuron*, nerve, and *pteron*, wing).—Literally "Nerve-wings;" an order of insects characterised by the finely reticulated nervures of their wings; whence the name. Several fossil species have been found in the oolitic strata of England and Germany, and these seem referable to the family *Libellulidæ* or Dragon-flies.

Neurópteris (Gr. *neuron*, nerve, and *pteris*, fern).—An extensive, but indifferently defined, genus of fossil ferns occurring abundantly in the Coal-measures, and also, but in less profusion, in the Permian, Trias, and Oolite. In *neuropteris* the leaves are usually bi-pinnate; leaflets more or less pointed at the apex, somewhat cordate at the base, and attached by the middle portion only, have no midrib but what is produced by the union of the nervures or veins, that proceed from the axis of the leaflet in branching well-marked lines to the margin, which is entire in the coal-measure and permian species, but occasionally slightly serrated in those of the oolite. The genus takes its name from the curved dichotomous veins of its leaflets; many of the species were of gigantic habits; and in several the pinnated divisions were furnished with a small circular leaflet, which, when detached, is apt to be mistaken for a cyclopteris.

New Red.—A brief expression for the new red sandstones (Permian and Triassic) which occur above the coal-measures, in contradistinction to the Old Red, which lies below.

New Red Sandstone.—Immediately above the coal-measures—in some instances lying unconformably on and in others insensibly graduating from them—occurs a set of red sandstones and pebbly conglomerates, yellowish magnesian limestones, and variegated shales and marls, enclosing irregular masses of rock-salt and gypsum. To this series of strata, as more especially developed in England, the earlier geologists applied the term *New Red Sandstone*, in contradistinction to the *Old Red Sandstone* system which lies beneath the Carboniferous formation. More recently it has been proposed to divide these new red sandstones, magnesian limestones, and saliferous marls into two distinct systems, the *Permian* and the *Triassic*—the former embracing the lower members, which are largely and typically developed in the government of Perm, in Russia; and the latter comprising the upper members, known as the "Trias," or triple group in Germany. The reasons for this new arrangement are, that the fossils of the magnesian limestone and lower red sandstones seem more closely allied to those of the coal-measures beneath, than to those of the variegated sandstones and saliferous marls above,—in other words, present a *palæozoic* aspect; while those of the upper sandstones and marls are decidedly *mesozoic*. To render this new arrangement more intelligible, let us suppose all the red sandstones, marls, and magnesian limestones hitherto known in England as "The New Red Sandstone," to be present in one section. We should then have, reposing unconformably on the coal-measures, the following series of strata:—

MESOZOIC, or TRIASSIC.	4. Series of coloured marls.	Purple-coloured marls below the lias. Alternations of red and bluish-white marls, with layers and nodules of gypsum. Thin layers of argillo-calcareous stone. Red and bluish marls, with gypsum and beds of rock-salt.
	3. Variegated red and white sandstone.	Red and white sandstone, mostly fine-grained, and often impregnated with salt. Red conglomerate, full of pebbles of older rocks.
PALÆOZOIC, or PERMIAN.	2. Magnesian limestone.	Red and white marls. Thin-bedded compact limestone, with very little magnesia, and few organic remains. Red and white marls and gypsum. White, yellow, or reddish magnesian limestone in thick beds, crystallised, compact, or earthy, often full of sparry cavities, and containing marine organic remains. Marl slate in thin layers, occasionally enclosing fishes.
	1. Yellow or purple sand and sandstone, and marl.	An extremely variable series of sandstones, sands, and clays of various colours, irregular thickness, and much local diversity of character. Plants like those of the coal-measures.

From the preceding tabulation, the reader will perceive at a glance the nature of the strata formerly designated the New Red Sandstone, as well

as the limits of the Permian and Triassic systems into which it is now divided, and which are still occasionally spoken of as the *Lower* and *Upper New Red Sandstones.*

Nickel (Ger.)—One of the metals; white, ductile, malleable, attracted by the magnet, and, like iron, capable of being rendered magnetic. Its specific gravity, when hammered, is about 9. It is rather more fusible than pure iron; is not altered by exposure to the air and moisture at ordinary temperatures, but is slowly oxidised at a read heat. It is found in all meteoric iron; but its principal ore is a copper-coloured mineral found in Germany, and called *nickeline* or *kupfer-nickel*—"nickel" being a term of detraction used by the miners, who expected from the colour of the ore that it would contain copper. Since the manufacture of German silver or *argentane*, nickel has, however, become an object of considerable importance, and is extracted from several ores, as from *Gersdorffite* or nickel-glance, *Nickeline* or copper-nickel, and the like. These are usually compounds (*speise*) of nickel, cobalt, antimony, arsenic, sulphur, or iron, and belong to the family PYRITES. The salts of nickel are mostly of a grass-green colour, and the ammoniacal solution of its oxide is deep blue, like that of copper.

Nickel Glance.—Known also as *Gersdorffite*, a greyish-white, massive and granular ore of nickel, occurring in the transition rocks of upper Germany, Sweden, Spain, Brazil, and other countries, and consisting, on the average, of 35.5 nickel, 45.2 arsenic, and 19.3 sulphur—part of the nickel being replaced by iron or cobalt.

Nickeline.—The *kupfer-nickel* or copper-nickel of Werner, and the *arsenical nickel* of other authors. One of the chief ores of nickel, occurring in strings and nodules, but generally massive and disseminated in veins (rarely in beds), in the granitic and crystalline rocks, and also in secondary strata associated with cobalt, silver, and copper. It is found abundantly in Germany, and to some amount in America, Cornwall, and other countries. It consists of 44 nickel and 54 arsenic (part of the latter being often replaced by antimony), with traces of sulphur, iron, cobalt, and lead. Family PYRITES.

Nidulítes (Lat. *nidus*, a nest).—Undetermined organisms occurring in Silurian strata, and so named because at first supposed to be the *nidi* or egg-masses of a gasteropod, similar to those of the modern natica. "This explanation," says Mr Salter, "fails, however, when the organism is more closely examined; since the cells are equal and regular on both sides of a central lamina, and are set back to back like the cells of a honey-comb." They seem more akin to the Bryozoa (*retepora* and *flustra*); but differ in their great size and in the absence of any plate or cover to the cells.

Nilsónia (after Nilson).—One of Brongniart's genera of Cycadaceous leaves occurring in the Lias and Oolite; but now ranked as a species of *Pterophyllum*, which see.

Nipadítes.—A genus of fossil palm-nuts found by Mr Bowerbank in the tertiary clays of the island of Sheppey, near London; and so called from their resemblance to the fruit of the existing *Nipa fruticans* of Bengal and the East India islands. The Nipa is allied to the cocoa-nut tribe on the one side, and on the other to the *Pandanus* or screw-pine. It is a low-growing plant, luxuriating in marshy tracts at the mouths of great rivers, particularly where the waters are brackish. And Mr Bowerbank remarks, that "if the habits of the plants to which the fossil fruits be-

longed were similar to those of the recent *Nipa*, it will account for their abundance in the London clay in the Isle of Sheppey; which formation, from the great variety of stems and branches, mixed up with star-fishes, shells of molluscs, and bones of fishes, crustaceans, and reptiles of numerous marine and fresh-water genera, is strikingly characteristic of the delta of a river, which probably flowed from near the equator towards the spot where these interesting relics are deposited."

Nitre (Gr. *nitron*).—The familiar as well as technical term for the *nitrate of potash*—46.6 potash, and 53.4 nitric acid. Known also as *saltpetre* and *prismatic nitre-salt*. "It is," says Brande (*Dict. of Science*), "spontaneously generated in the soil, and crystallises upon its surface in several parts of the world, especially in India, whence nearly the whole of the nitre used in Britain is derived. It has occasionally been produced artificially in *nitre beds*, formed of a mixture of calcareous soil and animal matter. In these nitrate of lime is slowly formed, which is extracted by lixiviation, and carbonate of potash added to the solution, which by double decomposition gives rise to the formation of nitrate of potash and carbonate of lime: the latter is precipitated; the former remains in solution, and is obtained in crystals by evaporation. Nitre crystallises in six-sided prisms; is soluble in seven parts of cold water, and in less than its weight of boiling water. It has a cooling taste, and is anhydrous. At 616° it fuses, and at a red heat is decomposed." It is used in glass-making, in medicine, as an antiseptic, for producing nitric acid, but especially, and most extensively, in the manufacture of gunpowder.

Nitratine.—The mineralogical term for the *nitrate of soda*—36.6 soda, and 63.4 nitric acid. Known also as *cubic nitre* or *rhombohedral nitre-salt*, from its crystallising in rhombic crystals. "This salt," says Nicol (*Man. of Mineral.*), "occurs in the district of Tarapaca on the northern frontier of Chili, where it forms beds averaging four feet thick, and extending forty leagues in length. It rests on marl containing fragments of shells in a basin-like pampa, and is mixed with various salts. It is supposed to have been left by the sea, but the chemical nature of the salt is against this opinion." It is largely used as a manure, and is employed in the arts as a substitute for nitre, but is unfitted for manufacturing gunpowder from its deliquescing in the air.

Nitrocalcite (*nitron*, and *calx*, lime).—Nitrate of lime, occurring in pulverulent efflorescences on old walls and in limestone caves, especially near decaying animal water. Has a greyish-white colour; sharp bitter taste; readily soluble in water; and consists of 32.00 lime, 57.54 nitric acid, and 10.56 water.

Nitrogen (Gr. *nitron*, and *ginomai*, I produce).—One of the elementary gases; so called from its being a constituent or generator of nitre. It is a colourless, inodorous, and tasteless gas, not absorbed by water, and has no action on vegetable colours. It extinguishes all burning bodies, is itself uninflammable, and, being unrespirable, is destructive of life; hence the earlier term *azote* (*a* priv., and *zoē*, life). It is somewhat lighter than atmospheric air, and combines with oxygen in *five* proportions, forming *nitrous oxide* (NO), *nitric oxide* (NO_2), *hyponitrous acid* (NO_3), *nitrous acid*, (NO_4), and *nitric acid* (NO_5). Nitrogen is an important element in nature. It constitutes four-fifths, or 79 per cent, of the volume of atmospheric air; it enters largely into the composition of many plants and animals, and forms their chief nutritive principle; is present in the native

nitrates of soda and potass; occurs in coal and a few other minerals, evidently of organic origin; and is given off by certain springs and volcanic vents.

Nitromágnesite.—Nitrate of magnesia; a saline efflorescence occurring in the same places with nitrocalcite or nitrate of lime, which it closely resembles in character, but consists of 24 magnesia, 65 nitric acid, and 11 water.

Nodosária (Lat. *nodosus,* knotted, full of knots).—A genus of foraminiferous organisms occurring in Chalk, Tertiary, and Recent formations; and so termed from the arrangement of their cells, which are somewhat clongated and placed end to end, forming a minute, knotty, or bead-like frustule—the last cell having a round central opening.

Nódule (Lat. *nodus,* a knot).—Any irregular concretion of rock-matter collected by attraction or aggregation round some central nucleus, as nodules of ironstone, flint, &c. *Nodular* concretions may be aggregated around either organic or inorganic nuclei.

Noeggeráthia.—A genus of palm-like leaves found in the Carboniferous and Permian systems; so named after Dr Noeggerath, who has done much for the elucidation of our fossil floras. In *Noeggerathia* the leaves are petiolated, pinnated; the leaflets nearly cuneiform, applied against the edges of the petiole, toothed towards the apex, and furnished with fine diverging veins.

Nonionína.—A genus of nautiloid foraminiferous organisms occurring in the Chalk, in tertiary strata, and in the existing seas. Their simple cells are arranged like the chambers of the nautilus, the last having a single narrow aperture.

Northern Drift.—A synonym of the "Glacial Drift" or "Erratic Boulder Group," because in the northern parts of Europe and America the materials seem to have been brought by polar currents from the *northern* to the *southern* regions.—See GLACIAL DRIFT.

Notídanus (Gr. *notos,* ridge, and *idanos,* beautiful).—A genus of fossil shark-teeth, each tooth having the crown or ridge composed of a series of sharp angular enamelled points, the first of which is the largest, and is notched on the anterior edge. The base of the tooth is bony, flat, and furnished with a longitudinal groove beneath the edge of the enamel. They are found in the oolite and chalk, but are specifically most abundant in the lower tertiaries.

Notopocorýstes (Gr. *notos,* the back; carapace).—A genus of cretaceous crabs, whose carapaces (the only portions yet definitely known) appear to have some relations with the existing genus *Corystes.* The corystes have elongated oval carapaces; have the tail folded under the body when at rest; have the first pair of their ten limbs chelate, the others terminating in a slender claw; and are furnished with two pairs of antennæ—the outer being long and setaceous.

Notórnis (Gr. *notos,* the south, and *ornis,* bird).—Literally "southern bird;" a short-winged rail or coot first known by its sub-fossil bones found in the sands and volcanic debris of New Zealand, and believed to be extinct; but subsequently one or two living specimens have been obtained.

Nothothérium (Gr. *notos,* the south, and *therion,* beast).—An extinct genus of gigantic quadrupeds found in the alluvial or upper tertiary deposits of Australia. As far as the teeth, jaws, and other scattered bones enable

the comparative anatomist to decide, the *Nototherium* manifests pachydermal modifications of the marsupial type ; hence the inference that Australia (whose largest native quadruped is now the kangaroo) was, immediately preceding the current era, inhabited by a marsupial vegetable-feeder as large as the rhinoceros.

Nováculite (Lat. *novacula,* a razor).—A mineralogical term for *whetslate,* in allusion to the principal purpose to which it is applied. Whetslates of sufficiently fine texture, and keen siliceous grain, are found among the clay-slates and mica-schists of most metamorphic districts.

Nucleolítes (*nucleus,* a little nut, and *lithos*).—A genus of sea-urchins belonging to the family *Clypeideæ,* and characterised by their oblong inflated shell, which is rounded in front and flat behind. The pores are united by grooves ; the mouth is sub-central ; and the vent in a deep furrow on the superior face. Several species occur in the oolite, chalk, and greensand ; one is known in tertiary strata ; and a recent species inhabits the seas of Australia.

Núcleus (Lat. *nux,* a nut, and *nucleus,* a little nut or kernel).—The solid centre of any nodule or rounded mass is said to be its nucleus ; the central matter round which any mass is collected or aggregated.

Núcula (Lat., a little nut).—An extensive genus of bivalves belonging to the family *Arcadæ,* and characterised by their trigonal inflated shells, with their umbones turned towards the short *posterior* side ; the valves smooth or sculptured ; margins crenulated ; hinge with prominent internal cartilage pit, and a series of sharp teeth on each side. Living in many seas on coarse bottoms from 5 to 100 fathoms ; and fossil from the lower Silurian upwards. The species having the shell oblong and rounded in front, with the posterior side produced into a long beak, have been erected into the separate genus *Leda.*

Nummulína, Nummulítes, Númmulite (Lat. *nummus,* a coin, and *lithos,* stone).—An extensive class of fossil foraminiferous organisms, so called from their general resemblance to a coin or piece of money. They occur in inconceivable numbers in certain rocks (the nummulitic limestone), and are of all sizes from a mere point to discs an inch and half in diameter—being thus the largest organisms of their class. Perfect specimens appear as a calcareous solid circular body of a lenticular shape ; smooth and slightly convex on both sides, and without any visible structure. On splitting the fossil transversely, or rubbing down one of the convex planes, a series of minute cells, arranged in discoidal spire, is brought into view ; and these cells, in the living organism, were all connected internally, as well as communicated externally, by minute pores or *foramina* for the free passage of the *sarcode* or fleshy substance of the protozoan. The nummulite would appear to be a strictly Tertiary form, being unknown alike in Secondary or in Recent deposits. It seems also to be an Old World form, its representative in time and in geological function in the New World being the genus ORBITOIDES, which see.

Nummulític Limestone.—An important member of the lower tertiaries (middle eocene) of the Old World, and so termed from the number and variety of nummulites with which it is charged. "The nummulitic formation," says Lyell, "with its characteristic fossils, plays a far more conspicuous part than any other tertiary group in the solid framework of the earth's crust, whether in Europe, Asia, or Africa. It often attains a thickness of many thousand feet, and extends from the Alps to the Car-

pathians, and is in full force in the north of Africa—as, for example, in Algeria and Morocco. It has also been traced from Egypt, where it was largely quarried of old for the building of the pyramids, into Asia Minor, and across Persia by Bagdad to the mouths of the Indus. It occurs not only in Cutch, but in the mountain-ranges which separate Scinde from Persia, and which form the passes leading to Caboul; and it has been followed still further eastward into India, as far as Eastern Bengal and the frontiers of China." As the *Nummulitic Limestone* seems characteristic of the Old World, so the *Orbitoidal Limestone* seems characteristic of the New—mountain-masses full 300 feet in thickness, and almost wholly made up of Orbitoides, occurring near Suggsville in North America, and apparently on the same, or nearly the same, geological horizon.

Nuthétes.—Abbreviated from the Greek *Nouthetetes*, monitor, in reference to the affinities of the fossil to the modern lizards so called. A carnivorous or insectivorous lizard from the Purbeck beds of the upper oolite, of the size of the great Land monitor of India, and furnished with serrated teeth for piercing, cutting, and lacerating its prey.

O

O'asis (Gr.)—In Physical Geography, a green and fertile spot in a desert; originally applied by Herodotus to the patches of vegetation which occur around springs in the Libyan desert.

Oblate (Lat. *oblatus*).—Generally applied to spherical bodies more or less flattened at opposite sides or poles; shaped like an orange. The Earth is an *oblate* spheroid, being flattened at either pole to the extent of about thirteen miles, and thus deviating from the true spherical or globular figure.

O'bolus (a small Greek coin).—A genus of bivalves belonging to the Lingula family, and characterised by their orbicular, smooth, calcareo-corneous, sub-equivalve shells, which have the hinge margin somewhat thickened inside, and the lower valve with a notch for the pedicle. There are several species occurring in the Silurians of Northern Europe; hence the "obolite grit" of Sweden and Russia.

Obsídian (Gr. *opsianos*, so called, it is said, from being used by the ancients for looking-glasses; others derive it from *Obsidius*, a Roman, who first brought it from Ethiopia).—A glassy lava almost undistinguishable from artificial glass-slag, and placed by mineralogists under the Felspar family. Its composition is variable, but it consists in general of about 80 silica, 10 alumina, with varying minor per-centages of potash, soda, lime, and oxide of iron. It is a true volcanic glass, of various colours, but usually black or blackish-grey; occasionally porphyritic from enclosed crystals of glassy felspar; has a specific gravity of about 2.37; is hard enough to scratch glass; and nearly opaque. It occurs in streams, or in detached masses near many volcanoes; and has been used by rude nations for the fabrication of mirrors, axes, knives, arrow-heads, and the like.

As might be anticipated from its origin, obsidian frequently graduates into *pumice* and *pearlstone,* which see.

Occípital (Lat. *occiput,* the hinder part of the head).—Belonging to the back part of the head; hence we speak of "occipital bones," "occipital parietes," &c.

Oceánic.—Belonging to, occurring in, or produced by, the ocean; hence we speak of "oceanic life," "oceanic currents," "oceanic deltas," and the like.

Ocellária (Lat. *ocellus,* a little eye).—A conical-shaped zoophyte occurring in chalk-flints, and so named by König from the numerous eye-like polyp-cells which stud its surface.

O'chre (Gr. and Lat. *ochra*).—A term familiarly applied to a well-known pigment, varying in colour from a pale yellow to a deep orange or brown, and consisting of iron peroxide and water, with varying proportions of clay in a state of impalpable subdivision. Strictly speaking, *ochre* is a hydrated peroxide of iron, consisting of about 80 of the peroxide, and 20 water; but is very rarely found absolutely pure, and appears to be a product of decomposition. It occurs in all formations, much of that used in Britain being obtained from beds in the Coal formation.——In Mineralogy the term *ochre* is also applied to other products of decomposition resulting from the oxidised ores, as *cobalt-ochre, bismuth-ochre, antimony-ochre, uran-ochre, chrom-ochre,* &c., most of them occurring as earthy masses or pulverulent incrustations.

Octaédrite.—A mineralogical term for the pure oxide of titanium, which occurs in elongated eight-sided crystals, in veins in the primary and crystalline rocks. Known also as *Anatase* and *Pyramidal Titanium ore.*

Octahédral or **Octaedral** (*octo,* eight, and *hedra,* side).—Having eight equal sides, as octahedral oxide of titanium, octahedral iron ore, &c.,—these ores occurring in eight-sided crystals.

Oculína (Lat. *oculus,* the eye).—A genus of stony branching corals, belonging to the family of Madrepores, and so called from the eye-like or star-like polyp-cells which stud its smooth, thick, short branches. The common *Oculina virginea* is often known as "white coral," in contradistinction to the *Corallium rubrum,* or "red coral" of commerce.

Odontáspis (Gr. *odous,* tooth, and *aspis,* buckler).—Literally "buckler-tooth;" a genus of shark-like fishes occurring in the chalk formation, and so termed from the buckler-like aspect of their teeth—the only portions yet known.

Odontólogy (Gr. *odous,* tooth, and *logos,* discourse).—That branch of anatomical science which treats of the teeth. "The term 'tooth,'" says Professor Owen, "has been applied in zoology and zoonomy to various organs and parts; usually to such as are so solid, so shaped, and so situated, as to serve for seizing and operating on the food; but it has been also applied to parts, such as the prominences on the hinge of bivalve shells, which have no relation to the digestive functions. The siliceous spines of infusorial animalcules, the calcareous jaws of sea-urchins, the chitinous hooks and hooklets of sea-worms, and many corresponding parts of invertebrate animals, are described as 'teeth;' but Odontology proper exclusively relates to those bodies, hardened chiefly by the phosphate of lime, which are attached to parts of the mouth or beginning of the alimentary canal, and which are peculiar to the vertebrated classes of animals. . . . True calcified teeth vary in their tissue and composition, and still more in regard to number, size, form, structure, position, and mode

of attachment in different animals. They are principally adapted for seizing, tearing, dividing, pounding, or grinding the food; in some they are modified, to serve as weapons of offence and defence; in others, as aids to locomotion, means of anchorage, instruments for uprooting or cutting down trees, or for transport and working of building-materials. They are characteristic of age and sex; and in man they have secondary relations to beauty and to speech. Teeth are always most intimately related to the food and habits of the animal, and are therefore highly interesting to the physiologist. They form, for the same reason, most important guides to the naturalist in the classification of animals; and their value as zoological characters is enhanced by the facility with which, from their position, they can be examined in living or recent animals; whilst the durability of their tissues renders them not less available to the palæontologist, in the determination of the nature and affinities of extinct species, of whose organisation they are often the sole remains discoverable in the deposits of former periods of the earth's history."—See *Owen's Odontography*, and article "Odontology" in *Encyclopædia Britannica.*

Odontópteris (Gr. *odous, odontis*, tooth, and *pteris*, fern).—A somewhat obscure genus of fossil ferns occurring in the Coal-measures, and so called from the blunt tooth-like lobes of their leaflets. In *Odontopteris* the leaves are bi-pinnated; leaflets lobed, membranous, adhering by all their base to the rachis, and furnished with a very indistinct midrib, from which a few ill-defined branching or simple veins pass into the lobes, which have no midrib.

Odour, as a characteristic of minerals, is not possessed by any of them in a dry unchanged state; but it may be obtained from several by moistening with the breath, by friction, by heat, or by the action of an acid. Hence we have the *argillaceous odour*, or the odour of moistened clay, when certain rocks, as chlorite and serpentine, are breathed upon; the *fetid*, or the odour of sulphuretted hydrogen obtained from certain limestones when rubbed or struck with the hammer; the *sulphurous*, obtained by friction from pyrites, or by heat from most of the sulphurets; and the *garlic odour*, obtained by friction from some, and by heat from most, of the arsenical salts and ores.

Œ'ningen Beds.—A remarkable lacustrine deposit of highly fossiliferous marls and limestones, occupying a hollow in the molasse near Œningen, where the Rhine issues from the Lake of Constance. They are of upper tertiary age, and are replete with remains of dicotyledonous plants, fresh-water shells, crustaceans, insects, fishes, and turtles, and have also yielded remains of quadrupeds.

Ogýgia (from *Ogyges*).—A genus of Silurian trilobites, so named in allusion to the obscure and remote character of these crustaceans, or from their being found in the lowest or earliest fossiliferous formations.

Ogýgian.—From *Ogyges*, one of the earliest of the Grecian monarchs. His origin, the age in which he lived, and the duration of his reign, are so obscure, that the term *Ogygian* is often applied to everything of dark or doubtful origin or antiquity. Chronologers date his reign at some two thousand years before the Christian Era.

Oldhámia.—A peculiar sertularian-like zoophyte, or perhaps polyzoon, occurring in the lowest Silurian or Cambrian rocks, and so termed because first detected by Professor Oldham in the purplish hard schists of Bray Head, near Dublin.

Old Men's Workings.—"In mining," says Ansted, "this term is used in reference to mines that have been formerly worked, and where underground excavations are found on reopening the mine. By *the old man*, miners mean any former workers of mines they are engaged in."

Old Red.—A brief expression for Old Red Sandstone in contradistinction to New Red—the former lying beneath, and the latter above the true Coal-measures. As a system of fossiliferous strata, the Old Red Sandstone is now generally treated under the term DEVONIAN.

Old Red Sandstone, or **Devonian System.**—Taking the Coal-Measures as a sort of middle formation, there is generally found in the British Islands one set of reddish sandstones lying beneath, and another set lying immediately above them. By the earlier geologists the lower set was designated the *Old Red Sandstone*, and the upper the *New Red Sandstone;* and though the progress of the science has rendered it necessary to impose certain limitations on these terms, they are still sufficiently distinctive and easily remembered. The Old Red Sandstone may therefore be held as embracing the whole series of strata which lies between the Silurian system on the one hand, and the Carboniferous system on the other. Certain portions of the system are peculiarly developed in Devonshire, and contain a copious and varied fossil fauna; hence the introduction by Murchison and Sedgwick of the term *Devonian*—a term now generally employed as synonymous with the earlier and more descriptive one of "Old Red Sandstone." Characterised on its lower margin by strata containing the remains of fishes, and which form a line of separation, as it were, between it and the underlying Silurian, and defined, on its upper margin, by the rarity of that vegetation which enters so profusely into the composition of the Carboniferous rocks, there can, in general, be no difficulty in determining the limits of the Old Red formation. On the whole, its composition is manifestly arenaceous, the great bulk of the system consisting, as the name implies, of a succession of sandstones, alternating with subordinate layers of sandy shale and beds of concretionary limestone. The sandstones pass in fineness from close-grained fissile flags to thick beds of coarse conglomerate, and the shales from sandy laminated clay to soft flaky sandstone. The whole system is less or more coloured by the peroxide of iron—the shades varying from a dull rusty grey to a bright red, and from red to a fawn or cream-coloured yellow. The "Devonian" proper, on the other hand, exhibits in its middle and upper portions an abundant development of fossiliferous limestones and calcareous shales, of slaty shales or dark bituminous-looking schists. Indeed, north of the Bristol Channel, the fossiliferous limestones, schists, and grits of Devonshire are altogether wanting; and the term "Old Red Sandstone" then becomes the more appropriate designation for the system. In the north of Europe a similar preponderance of arenaceous members prevails; while, on the Rhine and in Belgium, the fossiliferous limestones of Devon have their parallels in equally fossiliferous calcareous strata. Throwing the system into three great groups, as is usually done, we are presented with the subjoined co-ordinations:—

UPPER	Baggy Point sandstone and Morte Bay schists, N. Devon; goniatite limestone, Belgium; yellow sandstones of Dura-Den, Fife, with holoptychii and pterichthys; Telerpeton beds, Elgin (Triassic?); Cyclopteris beds of Kilkenny; red and white sandstones of Dunse.

MIDDLE	Ilfracombe and Plymouth limestones, Devon, and Eifel limestone, Belgium, both abounding in corals, crinoids, shells, trilobites, and occasional fishes. Red sandstones of Berwick and Roxburgh; red sandstones, marls, conglomerates, and cornstones of Hereford, Cumberland, Fife, Perth, and Forfar—the characteristic fossils being gigantic holoptychii.
LOWER	Caithness flags and shales, abounding in fishes—dipterus, osteolepis, coccosteus, cheiracanthus, &c.; N. Foreland, Porlock, and Torquay beds, Devon; Spirifer sandstones and shale, Rhine. Great pebbly conglomerates and flagstones of Forfar, with cephalaspis, cheiracanthus, and pterygotus; Ludlow and Lanark Tilestones, with pterygotus, eurypterus, and other kindred crustaceans.

Palæontologically, though yielding numerous plant-impressions and remains of corals, crinoids, shell-fish, trilobites, and eurypterites, the most marked and characteristic fossils of the system are, perhaps, its numerous and varied FISHES—often of peculiar forms, and covered with bony plates (*coccosteus, pterichthys, cephalaspis,* &c.); clad with hard, enamelled, and variously ornamented scales (*holoptychius, dipterus, asterolepis,* &c.), and not unfrequently armed with sharp, defensive fin-spines (*cheiracanthus, diplacanthus,* &c.)—See tabulations, "Geological Scheme."

Olígocene (Gr. *oligos,* small, and *kainos,* recent).—A term employed by M. Beyrich to designate certain Tertiary beds of Germany (Mayence, &c.), which appear to be neither exactly of Eocene nor of Miocene age, but to occupy an intermediate position.—*Oligocene,* a little more recent than Eocene—*slightly recent.*

Olígoclase (Gr. *oligos,* small, and *klasis,* fracture).—A mineralogical term for soda-felspar, in allusion to its peculiar fracture, as distinguished from *orthoclase* or potash felspar. According to Berzelius, it consists of 63.70 silica, 23.95 alumina, 8.11 soda, 1.20 potash, and 2.05 lime, with traces of magnesia and iron. It occurs in granites and porphyries; is of a white or whitish-grey colour, and melts easier than orthoclase or albite to a clear glass.—See FELSPAR.

O'livine. — An olive-coloured semi-transparent mineral, occurring in rounded grains and crystals in many basalts and lavas. It is common in the basaltic greenstones of Scotland, and consists of about 40 silica, 48 magnesia, 11 iron protoxide, with traces of manganese and alumina. Fine green-coloured transparent crystallised varieties are known as *Crysolite,* and occasionally used as gems, though not much valued on account of their softness and frequent flaws.

O'mbria (Gr. *ombrios,* rain).—An early, but now disused, term for fossil sea-urchins (*echinites, cidarites, galerites,* &c.), which were supposed to have fallen from heaven in showers.

O'nchus (Gr. *onchos,* bent or hooked like a talon or arrow-barb).—According to Agassiz, a genus of Cestracionts found in the Silurian, Devonian, and Carboniferous formations. Their fin-spines or dorsal rays only are known, and of these seven or eight species are enumerated. They are wide at the base, and bent backwards, with their posterior margin destitute of teeth.

Onyx.—The general term for those varieties of agate which consist of

alternate layers of white, brown, or black, and which were greatly valued by the ancients for cameos. The word is Greek, and signifies *nail,* in allusion to the parallel bands of the mineral resembling those frequently seen on the human nail. High prices are often given for genuine antique onyx cameos.

O'olite (Gr. *oon,* an egg, and *lithos,* stone).—A variety of limestone, so termed from its being composed of small rounded grains, resembling the eggs or roe of a fish—each grain having usually some minute fragment of sand as a nucleus, around which concentric layers of calcareous matter have accumulated. When the grains are very distinct and well-rounded, the term *roestone* is sometimes used as a synonym; and when they are large and pea-like, the rock is known as *pisolite* or pea-stone (*pisum,* a pea). The marked occurrence of these oolites or roestones, in certain of the secondary strata of England, has given the name not only to the OOLITE FORMATION, properly so called, but also to the OOLITIC SYSTEM as now extended by modern geologists.

Oolíthes (Gr. *oon,* egg, and *lithos,* stone).—A general term for the fossil eggs of birds, reptiles, and oviparous animals—those of birds having been found in recent and upper tertiary formations (*Æpiornis*), and those of reptiles in tertiary, and even, as recently supposed, in oolitic strata (*Oolithes Bathonicæ*). The supposed egg-packets, or spawn of crustaceans, *Parka decipiens,* occur abundantly at the very base of the Old Red Sandstone; and that of mollusca (*Nidulites*) so early as the Silurian system.

Oolitic or **Jurassic System.**—Deriving its name from the prevalence of limestones of an *oolitic texture* as developed in England, or from the *Jura range,* as typically exhibited on the continent of Europe. This system may be said to comprehend the whole of those peculiar limestones, calcareous sandstones, marls, shales, and clays which lie between the New Red Sandstone beneath and the Chalk formation above. And however similar these strata may be in some features, there is no truth in geology more fully established than this, that where the system is complete, the argillaceous laminated limestone and shales termed the *Lias* constitute the lowest group; the yellowish granular limestones, calcareous sandstones, sands and clays, called *Oolite,* the middle group; and the greyish laminated clays, with subordinate layers of limestone and flaggy ferruginous sandstones, the *Wealden* or upper group. Taking these groups in descending order, the following synopsis exhibits their subdivisions as typically developed over extensive areas in England:—

WEALDEN	WEALD CLAY.—Greyish or bluish laminated clays imbedding concretions of ironstone, thin layers of argillaceous limestone, and sandy ferruginous flags. HASTINGS SANDS.—Sands and sandstones frequently ferruginous, with partings of clay; beds of clay and sandy shale more or less calcareous, with subordinate beds of limestone.
OOLITE	PURBECK BEDS.—Estuary limestones alternating with sands and clays (formerly grouped with the Wealden). UPPER OOLITE.—Coarse and fine grained oolitic limestones, with layers of calcareous sand and concretions (*Portland stone and Shotover sand*); dark laminated clays, with gypsum and bituminous shale (*Kimmeridge clay*).

OOLITE	MIDDLE OOLITE.—Coarse-grained, shelly, and coralline oolite, with calcareous sands and grit (*Coral rag*); dark-blue clays, with subordinate clayey limestones and bituminous shale (*Oxford clay*); shelly calcareous grit (*Kelloway rock*), with subjacent blue clays.
	LOWER OOLITE.—Coarse, rubbly, and shelly limestones (*Cornbrash*); laminated shelly limestones and grits (*Forest marble*); sandy layers and thick-bedded blue clay (*Bradford clay*); thick-bedded oolite, more or less compact and sandy (*Bath or great oolite*); flaggy grits and oolites (*Stonesfield slate*); marls and clays with soft marly limestone (*Fuller's earth*); calcareous freestone, irregularly oolitic, and yellow sand (*Inferior oolite*).
LIAS	UPPER LIAS.—Thick beds of dark bituminous shale; beds of pyritous clay and alum shale; indurated marls or marlstone.
	LOWER LIAS.—Dark laminated limestones and clays; bands of ironstone; layers of jet and lignite; beds of calcareous sandstone.

All the members are well developed in England; it is chiefly the lias and oolite that are found in France, Switzerland, and Germany; patches of the lias and oolite occur in Scotland; the oolite alone in Hindustan and North America; and beds of Wealden epoch have been detected in Hanover and Westphalia. As deposits, the lias and oolite are eminently marine, though occasionally exhibiting evidence of alternate elevation and depression; while the Wealden and Purbeck beds display frequent alternations of marine with fresh-water or estuary conditions.

With the exception of the higher mammalia, almost every existing order is represented in the fauna of the Oolite, but the forms are all Mesozoic, and died out at the close of the chalk era. The vegetation of the system is also extremely varied, but the highest orders appear to be coniferous, and as yet no example of a true exogenous timber tree has been detected. Of its numerous fossils the most characteristic are the *cycadaceæ*, of which the stems, fruits, and leaves are found in abundance; the shells of the *gryphæa*, so peculiarly plentiful in the lias; the *ammonites* and *belemnites* of innumerable species; the *insects* of the lias and weald; the *pterodactyle*, or flying-lizard; the fresh-water and marine *turtles*; and, above all, the *ichthyosaurus*, *plesiosaurus*, and other sauroid reptiles, whose marvellous forms and variety have suggested for the oolite the not inappropriate title of "the age of reptiles." Still higher in the scale of being than these are the warm-blooded marsupial mammals, *amphitherium*, *phascolotherium*, *spalacotherium*, *stereognathus*, *triconodon*, and *plagiaulax*—the earliest of their kind yet detected in the crust of the earth. For further details see LIAS and WEALDEN; and for foreign and contemporary equivalents see tabulations, "Geological Scheme."

Opal (origin unknown, but supposed to be connected with the Greek word *ops*, *opos*, signifying vision).—The *quarz resinite* of Haüy; the *uncleavable quartz* of Mohs; and in its pure state a *hydrate of silica*, consisting of from 90 to 95 of silica, and from 5 to 10 of water. In most of its varieties there is some admixture of alumina, lime, and iron; hence, as a mixed siliceous mineral, it is allied to agate and chalcedony, but distinguished by its peculiar vitreous or rather resinous lustre. It occurs colourless or of all colours; is amorphous; in the compact varieties has a

conchoidal fracture, but in others is splintery, or even earthy. The better-known varieties are, 1. *Precious* or *noble opal,* which owes its beautiful play of colours to a multiplicity of minute pores in the mass; 2. *Hydrophane,* or those sub-varieties of noble opal which, when immersed in water, become transparent by the filling up of the pores; 3. *Sun* or *fire opal,* or *girasol,* transparent, of a brilliant vitreous lustre, and generally of a bright hyacinth red or yellow when held between the eye and the light; 4. *Hyalite, glassy opal,* or *Müller's glass,* occurring in transparent, very glassy, small mammillary incrustations; 5. *Common opal,* semi-transparent, vitreous, and of various colours; 6. *Semi-opal,* duller and less pellucid than common opal, and often of variegated colour; 7. *Cacholong,* or *mother-of-pearl opal,* having a pearly resinous lustre, and so called from its being found near the river Cach in Bucharia; 8. *Wood opal,* or wood converted into opal by siliceous infiltration, but still retaining its woody texture; 9. *Jasper opal,* or such ferruginous varieties as pass imperceptibly into common variegated jasper; and, 10. *Menilite* or *liver opal,* a compact semi-resinous variety found at Mont Menil, near Paris, and usually of a dark brown or liver colour. Besides the above there are other kinds enumerated by lapidaries, but these are for the most part founded upon very minute and unimportant distinctions.—See each variety under its own designation.

Opaléscent.—Resembling opal in lustre; exhibiting a play of colours like some varieties of opal; displaying iridescence.

Opalísed.—Converted into a substance resembling opal; converted into opal by the infiltration of silica in a state of solution (natural gelatine of silica). Hence "opalised wood," or wood petrified by silica, and acquiring a structure resembling opal.

Open Cast.—In Mining, the method of working a vein when the ore appears at the outcrop, and can be obtained by workings open to the day, and without sinking a shaft.

Opérculum (Lat., a lid).—In Conchology, the calcareous or horny lid with which gasteropodous molluscs (like the periwinkle) close the aperture of their shells when they withdraw within them for shelter. By some conchologists (Adanson, Gray, &c.), the operculum is considered as the equivalent of the right valve of the *Conchifera* or bivalves; but however similar in appearance, its anatomical relations are held by others to be altogether different. Opercular-like organisms are frequently found fossil.——In Ichthyology, the gill-cover or bony flap which covers and protects the gills in fishes. Opercular bones are frequently found detached in "bone beds" and other fossiliferous strata.——In Botany, the membranous lid which covers the *theca* or spore-case in mosses.

Ophídian (Gr. *ophis,* a serpent).—A serpent; belonging to the serpent order—the *Ophidia* constituting one of the main orders of Reptiles in Cuvier's arrangement.

O'phite and **Ophíolite** (Gr. *ophis,* a serpent, and *lithos*).—Mineralogical terms for serpentine, but seldom used by British geologists.—See SERPENTINE.

Oracánthus (Gr. *oraios,* beautiful, and *akantha,* spine).—A genus of cestraciont fin-spines, or ichthyodorulites, occurring in the Carboniferous formation, and so termed from the varied ornamentation of the species.

Orbiculína (Lat. *orbicula,* a little orb).—A genus of minute foraminiferous chambered shells, so called from their flattened globular form. Species of the genus are still living in tropical seas, and others are found fossil in the oldest tertiaries.

Ores (Ger. *erz*).—Metals occurring in nature in a state of purity are said to be *native;* when combined with other substances, so as to require various processes for their separation, they are termed *ores; e.g.*, the sulphurets and carbonates of copper in contradistinction from the pure ductile metal. Geologically, these ores may be found in veins, in indeterminate masses, or in regular strata; and the associated mineral matter is known as the *matrix, gangue, vein-stone*, or *ore-stone* of the metal. Ores of one or other of the metals occur in all formations, but most abundantly and availably in districts that have been subjected to subterranean disturbance and metamorphic agency. The idea that certain metals are peculiar to certain geological epochs, or rather that they occur in certain rock-formations more abundantly than in others, is one that derives support more from the disturbing and metamorphic agencies to which these formations have been subjected, than from any chronological succession or development of the metals themselves. The metals are the same in all times: their ores only appear in different states in different formations, and segregated or collected more abundantly in some localities than in others. It is usual to describe the *metallic ores* as occurring in the four following conditions:—1. In a metallic state, and either solitary or combined with each other; in the latter case forming "alloys." 2. Combined with sulphur forming sulphurets. 3. Combined with oxygen forming oxides. 4. Combined with acids forming carbonates, phosphates, &c., which generally go by the name of "metallic salts."

Organic (Gr. *organon*, a member or instrument).—Applied to plants and animals as being supplied with certain organs or instruments for the purposes of growth and nutrition. Their structure is said to be *organic*, and they are termed *organised* bodies, in contradistinction to minerals which are *inorganic*, and whose increase takes place by external additions, and not through the instrumentality of any peculiar organs. The term **Organic Remains** is used as synonymous with *fossils*, and applies to all remains of plants or animals found imbedded in the crust of the earth.

Orníthichnítes (Gr. *ornis, ornithos*, a bird, and *ichnon*, a footprint).—Footsteps supposed to be those of birds, and found abundantly on the sandstone slabs of the Trias, especially on the sandstones of the Connecticut valley in North America. Many of these are of gigantic size, and would seem to indicate the existence of cursorial and grallatorial birds three or four times the size of the existing ostrich. Professor Hitchcock has been the great elaborator of the Connecticut footprints, and considers many of them as undoubtedly those of birds; but Professor Owen, while admitting the close resemblance, administers the following necessary caution:—"Footprints alone, like those termed 'Ornithichnites,' are insufficient to support the inference of the possesion of the highly developed organisation of a bird of flight by the creatures which left them. The Rhynchosaur and biped Pterodactyles already warn us how closely the ornithic type may be approached without the essential characters of the saurian being lost. By the Chirotherian ichnolites we learn how closely an animal, in all probability a Batrachian, may resemble a pedimanous mammal in the form of its footprints." On the other hand, the marked tri-dactylous form of the footprints, the texture of the epidermal impressions, and the amount of uric acid contained in the coprolites usually associated with them, afford pretty strong presumptive evidence of their really being the footsteps of birds.

Ornithocópros (Gr. *ornis, ornithos*, a bird, and *kopros*, dung).—Literally

"bird-excrement;" a term occasionally applied to guano, which is, in the main, composed of the droppings of countless seafowl, and some accumulations of which are semi-mineralised, and evidently of vast antiquity.

Ornithoidichnítes (Gr. *ornis, ornithos,* a bird; *eidos,* resemblance; and *ichnon,* a footstep).—Literally "bird-like footprints;" a term denoting *resemblance* merely, without affirming, as "ornithichnites" does, that they are really the footmarks of birds.

Ornitholítes (Gr. *ornis,* a bird, and *lithos,* stone).—The general term for the remains of birds occurring in a fossil state. From the absence of teeth in Birds, and the close approximation of the form in many genera, it is often all but impossible to determine the relations of the *ornitholites* that occasionally turn up to the palæontologist. As yet they have been found only in the newer formations—the Chalk and Tertiaries.

O'rodus (Gr. *oraios,* beautiful, and *odous,* tooth).—A genus of cestraciont or palatal fish-teeth occurring in the Carboniferous system, and so termed from the beauty of their varied specific forms.

O'rpiment (an abbreviated corruption of the Latin word *auripigmentum,* or golden pigment).—Yellow sulphuret of arsenic, consisting, according to Klaproth, of 62 arsenic and 38 sulphur. It is found in metalliferous veins, and imbedded in various formations, and occurs in foliated masses, in concretions, or in minute crystals. The foliated structure of orpiment, and its arsenical odour when exposed to heat, distinguish it from native sulphur. *Red orpiment* is the name frequently given to the bi-sulphuret of arsenic or REALGAR, which see.

Orthis (Gr. *orthos,* straight).—A genus of fossil bivalves, known only in palæozoic strata, and taken as the type of the family *Orthidæ.* They are characterised—shell transversely oblong, radiately striated, valves slightly convex, beak inconspicuous, hinge-line narrower than the shell, rarely foraminated. In the silurian sub-genus **Orthisina** the shell is impunctate, widest at the hinge-line, and generally perforated by a small round foramen.

O'rthite (Gr. *orthos,* straight).—A silico-aluminate of cerium, so called by Berzelius from its occurring in straight needle-shaped or columnar masses in the granites of Scandinavia. It is closely related to, if not identical with, the *Allanite* and *Cerin* of other mineralogists.

Orthocánthus (Gr. *orthos,* straight, and *akantha,* spine).—A genus of straight cylindrical fin-spines occurring in the Carboniferous formation, and belonging to some unknown cestraciont.

Orthóceras, Orthocératite (Gr. *orthos,* straight, and *keras,* horn).—A genus of straight tapering chambered shells, so called from their tapering to a point like a horn. They occur from the Silurian to the Trias inclusive—many of their fragments indicating a length of more than six feet.

Orthocerátidæ (Gr. *orthos,* straight, and *keras,* a horn).—A family of fossil cephalopodous chambered shells, so called from their tapering horn-like shape—some being straight, others curved, and some discoidal. The family includes such generic forms as *orthoceras, gomphoceras, oncoceras, phragmoceras, cyrtoceras, gyroceras,* &c., all of which are peculiar to the older formations. In all, the shell was essentially external; had a small body-chamber, into which the animal partly withdrew; had a complicated and large siphuncle; and was less calcified than in the nautilus and ammonite.

O'rthoclase (Gr. *orthos,* straight, and *klasis,* fracture).—A mineralogical term for potash-felspar, because of its straight flat fracture. Orthoclase is often known simply as *felspar* or *prismatic felspar;* and whether in its trans-

parent or translucent varieties termed *adularia*, in the less splendent varieties known as *common felspar*, or in the glassy potash-soda variety known as *sanadine* or "glassy felspar," is one of the most important constituents of the globe—occurring not only in granite, gneiss, and porphyry, but in many secondary formations composed of their debris, as in greywacke, and some sandstones and conglomerates. Orthoclase is very readily weathered and decomposed, and in this state falls down to the whitish earth or clay known as *kaolin*, and extensively used in the manufacture of porcelain and stoneware. *Compact felspar*, or *felstone* as it is sometimes termed, seems generally an admixture of orthoclase and quartz, and in this state, or in its softer and earthier condition of *claystone*, constitutes an important member of the Trap series.—See FELSPAR.

Orthonóta, Orthonótus (Gr. *orthos*, straight, and *notos*, the back).—A provisional sub-genus of Modiola-looking bivalves occurring in Palæozoic strata, and so termed from their long straight plaited backs. The subdivisions of these elongated modiola-like shells are by no means well established.

Oryctólogy (Gr. *oryktos*, dug up, and *logos*).—Literally, the "Science of things dug up," that is, of all bodies, whether organic or inorganic, found buried in the earth. It was generally employed, however, as synonymous with Palæontology, and referred alone to fossils. It is now entirely disused.

Os or **Osar**.—A Swedish term for those elongated hillocks or mounds of gravel belonging to the Drift or Glacial period, and which are abundantly and characteristically scattered over Sweden and the islands of the Baltic. The greater part of the gravel of these hills, which occasionally rise to 100 or 200 feet, is of small dimensions, and mixed with much sand, and they almost always exhibit a slope and a scarped side; the former being towards the north, which is the source of the detritus.

Osmeroides (Lat. *osmerus*, the smelt).—A genus of fossil fishes found in the Chalk of England by Dr Mantell, and so named by Agassiz from their resemblance to the smelt. There are two or three species known to palæontologists.

O'smium (Gr. *osmè*, odour).—A metal discovered by Tennant in crude platinum, and so named from the strong disagreeable odour given out by its oxide. Two native alloys of osmium and iridium are known to mineralogists under the names *osmiridium* and *iridosmium*, both of which are found in flattish grains or scales in the gold and platina sands of the Ural. Their composition is variable.

Osseous (Lat. *os*, a bone).—Bony; containing bone; resembling bone in texture or structure.

Osseous Breccia (Lat. *os*, a bone).—Bones and fragments of bones cemented together by calcareous or other matter, and found in caverns and fissures, are so termed. The "Bone breccias" of Gibraltar and other parts of the Mediterranean shores are well known to geologists; and accumulations of a similar nature, though containing the remains of very different animals, have been discovered in Australia. The Mediterranean breccias consist wholly of the bones of land animals, and of these comparatively few belonging to Carnivora; while the absence of marine remains and of the usual abrading effects of water, shows that the breccia was formed on dry land, and not beneath the sea. "The only rational explanation of these facts" (says Dr Mantell, speaking of the Mediterranean bone breccias), "is that which assumes the original union of these distant rocks

and islands into a continent or large island, which, like Calabria, was subject to repeated visitations of earthquakes; and that the animals which inhabited the country fell into the fissures thus produced, and were preserved by the calcareous infiltrations that were constantly in progress. Subsequent convulsions and denuding agencies severed the country into rocks and insular masses, of which catastrophes the osseous conglomerates are the physical and only records."

O'ssicle (Lat. *ossiculum*, a little bone).—A small bone; applied in Anatomy to various small bones of the skeleton; also to the calcareous or bony-like joints and segments of encrinites, star-fishes, and similar animals.

Ossíferous (Lat. *os*, a bone, and *fero*, I yield).—Containing or yielding bones or fragments of bones, as many of the post-tertiary sands and gravels. Thus we have ossiferous gravels, ossiferous marls, ossiferous caverns, &c.

Ossíferous Caverns, Breccias, and Gravels.—Of more recent date than the newest pliocene lignites, clays, and marls, there occur in many regions (the northern hemisphere especially) gravels replete with bones of terrestrial and marine mammals (*ossiferous gravels*); cemented and stalagmitic bone-breccias in caves and fissures (*osseous breccias*); and caverns in limestone ridges filled with bones imbedded in ochraceous mud or stalagmite (*ossiferous caverns*), some of these the skeletons of animals that had laired and died there, and others that had been dragged thither and devoured by carnivora, or had been drifted by waves and currents, while the sea and land stood at varying and variable levels. Though generally of more recent date than the true Tertiaries, many of these cave-deposits are of vast antiquity—their lower floors containing the remains of pliocene or post-pliocene genera; the middle deposits the remains of true pleistocene species; while the upper layers of mud and stalagmite imbed the bones, charred wood, and rude stone-implements of the human race. Their epoch, therefore, as regards their organic remains, is partly pleistocene, and partly recent; and though the caves themselves were originally excavated by the waves of pliocene seas, most of them have undergone extensive changes alike during the pleistocene and current eras. The most remarkable *ossiferous caverns* in England are Kirkdale Cave near Kirkby Moorside in Yorkshire, the Dream Cavern near Worksworth in Derbyshire, Banwell Cave in the Mendip Hills, Kent's Hole and Brixham Cave near Torquay, Oreston near Plymouth, Cefn near Denbigh, and Paviland near Swansea. In Germany the slopes of the Harz mountains give us the caves of Baumann, Biel, and Schwazfeld; between the Harz and Franconia is the Bear Cavern of Glucksbrunn; the Jura formation near Baireuth is celebrated for the rich associated caverns of Gailenreuth, Wunderhole, Rabenstein, Kahloch, Zahnloch, Schneiderloch, &c. In Westphalia the same oolitic formation has the caves of Kluterhole and Sandwich. The caves of Adelsberg in Carniola, and the Dragons' caves in Hungary, have also yielded bones. In France, instructed by Dr Buckland's researches, two caverns, rich in bones, have been described by M. Thirria, near Vesoul, and several others near Narbonne by Marcel de Serres, Tournal, Christol, &c., and one near Miremont by M. de la None.——*Osseous breccia* appears singularly connected with the coasts of the Mediterranean. It occurs at Gibraltar, in Languedoc, and at several other points in the south of France, at Antibes, Nice, Pisa, Cape Palinurus, north of Bastea in Corsica, Cagliari in Sardinia, Meridolce and Maccagnone in Sicily, in Dalmatia, &c. Ferruginous breccia, in which bones are associated with pisolitic iron-ore,

occurs in Würtemberg, and in Carniola in Jura limestone. Such are a few of the best known of these curious repositories, whose characteristic *Mammalian remains* may be briefly tabulated as follows :—

Pachyderms.—Elephas, Mastodon, Hippopotamus, Chæropotamus, Rhinoceros, Tapir, Sus, &c.
Solipeds.—Equus.
Ruminants.—Cervus, Antelope, Urus, Bos, Merycotherium, &c.
Carnivors.—Felis, Hyæna, and the peculiar hardened excrement, *album græcum*, of the hyæna, Machairodus, Ursus, Gulo, Wolf, Fox, Polecat, Weasel, Otter, &c.
Rodents.—Porcupine, Beaver, Arvicola, Rat, Lagomys, Hare, Rabbit, &c.
Edentates.—Megalonyx, Megatherium, Macrauchenia, Manis, &c.

Osteólepis (Gr. *osteon*, a bone, and *lepis*, scale).—Literally "bony-scale;" a genus of ganoid fishes peculiar to the Old Red Sandstone, and so named from the enamelled bony character of its scales. There are three or four species catalogued by palæontologists; but in all the rhomboidal bony scales, the enamelled osseous plates of the head, and the thickly-set bony rays of the fins, are the distinguishing characteristics.

Osteólogy (Gr. *osteon*, a bone, and *logos*, discourse). — Literally "the science of bones;" a knowledge of the skeleton or bony fabric of the different tribes of animals; comparative anatomy. "The organs of every animal," observes Cuvier, "must be regarded as forming a machine, the parts of which are mutually dependent on each other, and exquisitely adapted for the functions they have to perform; and such is the intimate relation of the several organs, that any variation in one part is constantly accompanied by a corresponding modification in another." It is by a knowledge of this law that the palæontologist is enabled to reassemble, as it were, the scattered remains of the beings of a former state of the globe —to determine their place in the scale of animated nature, and to reason on their organisation, habits, and economy, with as much clearness and certainty as if they were still living before him. Hence the ready determination of a Carnivorous cutting-tooth from an Herbivorous grinding one, and that again from the chisel-like tooth of a Rodent; so also of the articulation of the jaw that has to cut, the jaw that has to grind, and that which has to gnaw; the foot that has to seize, the foot that has to run, and the foot that has to burrow.

O'stracite.—A term occasionally applied to any fossil oyster, or oyster-like shell whose species is undetermined.

Ostréidæ (Lat. *ostræa*, an oyster-shell).—The Oyster family, of which the common oyster is taken as the representative. The family is characterised by the shell being inequivalve, slightly inequilateral, free or adherent, resting on one valve; beak central, straight; ligament internal; epidermis thin; muscular impression single, behind the centre; and hinge usually toothless. The family is strictly marine, and includes the *oyster*, *anomia*, *placuna* or window-shell, the *pecten* or scallop, *lima*, the *spondylus* or thorny-oyster, and the *plicatula*. Of the living oyster there are about sixty species inhabiting tropical and temperate seas; while palæontologists enumerate about 200 fossil species occurring in strata from the carboniferous limestone upwards.

Otópteris (Gr. *ous*, *otos*, an ear, and *pteris*, fern).—A doubtful genus of fossil ferns occurring in the coal-measures, new red sandstone, and oolite,

and so called in allusion to the auricle (or ear-shaped projection) with which the bases of their leaflets were furnished. According to Lindley, who erected the genus, *Otopteris* was probably a simply pinnated plant with a thickish petiole; had oblong obtuse leaflets attached to the petiole by the lower half of the base, the upper being free and auricled; the leaflets were without midrib, and furnished with veins which originated in the base, and curved right and left to the margins, only forking as they proceeded towards the extremity.

Oudénodon (Gr. *oudeis*, none, and *odous*, tooth).—A sub-genus of Dicynodont reptiles from the sandstone rocks of Rhenostorberg, South Africa; and so termed by Mr Bain, their discoverer, from their toothless jaws, which may possibly (after the analogy of the Narwals) be those of the females of tusk-bearing male dicynodonts.

Out-crop.—The edge of any inclined stratum when it comes to the surface of the ground is called its *out-crop, crop, basset*, or *basset-edge.* In mining language a stratum, when it comes to the surface, is said to "crop out;" and we also hear such phrases as its "coming to the day," "rising to the grass," and so forth—all expressive of its position as regards the surface.

Outliers.—Portions of any stratified group which lie detached, or out from the main body, the intervening or connecting portion having been removed by denudation. Outliers may be identified with the main formations by the composition and alternations of their strata, and partly also by their fossils.

Oviferous, Ovígerous (Lat. *ovum*, an egg, *fero* and *gero*, I bear).—Egg-carrying; applied to certain animals (*e.g.*, some spiders and crustaceans) that carry about with them their eggs after exclusion—being provided for that purpose with ovisacs, egg-packets, or other apparatus.

Ovíparous (Lat. *ovum*, egg, and *pario*, I produce).—Literally "egg-producing," as distinguished from *viviparous* or "young-producing." Applied to birds, reptiles, fishes, &c., whose mode of generation is by the exclusion of a germ in the form and condition of an egg, the development of which takes place out of the body, either with or without incubation.

Ovisac (Lat. *ovum*, egg, and *saccus*, bag).—The egg-bag or membrane which invests or connects in one mass the eggs, spawn, or roe of crustacea, spiders, insects, shell-fish, and other allied creatures. Such *ovisacs* or *egg-packets* occur in a fossil state in ancient as well as in recent formations; *e.g.*, *Parka decipiens* in the lower Old Red, which is regarded by many as the ovisacs of *Pterygoti.*

Ovovivíparous (Lat. *ovum*, egg; *vivo*, I live; and *pario*, I produce).—Applied to animals whose mode of generation is by the exclusion of a living fœtus, more or less extricated from the egg-coverings, and which has been developed or hatched within the body of the parent as an *egg*—that is, without any placental attachment to the womb. The marsupials (kangaroo, &c.) among Mammals, the viper and salamander among Reptiles, the blenny and dogfish among Fishes, the *paludina vivipara* and many bivalves among Molluscs, the scorpion and flesh-fly among Insects, the earth-worm and many of the intestinal worms, are examples of *Ovoviviparous* animals.

O'xalite.—Known also as *Humboldtine;* a native oxalate of iron occurring in yellowish capillary crystals in the brown coal of Germany.

Oxford Clay.—The lower member of the Middle Oolite, so called from its

being well developed in Oxfordshire and the Midland Counties of England. It consists of a bed of stiff, pale-blue, more or less calcareous clay (locally known as "clunch"), attaining in some places a thickness of from 200 to 500 feet, and abounding in ammonites and belemnites. It is capped by the "coral-rag," and graduates below into the shelly concretionary limestone known as "Kelloway Rock."—See OOLITE.

Oxide.—Any substance combined with oxygen, without being in the state of an acid; **Oxidised,** converted into an acid, by combination with oxygen; **Oxidation,** that process by which metals and other substances are converted into oxides.

O'xygen (Gr. *oxys*, acid, and *gennao*, I produce).—Literally "the acid-former;" so called from its property of forming acids when in combination with other elementary substances. It is one of the simple or elementary bodies, and one of the five that exist in a gaseous state. It was discovered by Priestly in 1774. As a permanent gas it is colourless; has neither taste nor smell; and is slightly heavier than common air, the proportion being as 11 to 10. It is sparingly absorbed by water, and is neither acid nor alkaline. It has a powerful attraction for most of the simple substances, forming with them *acids* and *oxides*—this *oxidation* being often rapid and attended with the evolution of heat and light (as in burning), and at other times slow, unattended with such phenomena (as in rusting of the metals). It is a most powerful supporter of combustion—the products of such combustion being sometimes *gaseous*, as carbonic acid, from the burning of charcoal; *liquid*, as water, from the burning of hydrogen; or *solid*, as oxide of iron, from the burning of that metal. As an element it is one of the most important and generally diffused in nature—forming one-fifth of the atmospheric air; one-third, by measure, of the gases that constitute water; and so generally does it combine with all metallic and non-metallic bodies, that it has been computed that about one-half of the ponderable matter of the crust of the earth is composed of oxygen gas. It plays also a most important part in the vital economy of the globe, being inspired by animals who give out carbonic acid gas, while carbonic acid gas is absorbed by plants, which assimilate the carbon and set free the oxygen again to be breathed by animals, and thus maintain the grand harmonies of nature.

Ozókerite (Gr. *ozos*, odour, and *keros*, wax).—One of the mineral resins or rather fats; a soft semitranslucent fatty substance of a yellowish brown colour and pleasant aromatic odour, occurring in bituminous sandstones of the coal formation. It melts at about 144° into a clear oily fluid; and is a pure hydro-carbon, consisting of 86 carbon and 14 hydrogen.

P

Pachycórmus (Gr. *pachys*, thick, and *kormos*, body).—Literally "thick-body;" a genus of Sauroid fishes occurring in many specific forms in the Lias of England, and so named by Agassiz in allusion to their relatively robust bodies.

Pachydérmata (Gr. *pachys*, thick, and *derma*, skin). — Thick-skinned mammalia; an order which includes the elephants, rhinoceroses, tapirs, &c. among living species, and the mastodon, palæotherium, &c. among extinct tertiary races. The Pachyderms are perhaps the most prevalent forms in European tertiaries, a region in which the pig is now their sole representative.—See tabulations, "Animal Scheme."

Pachýpteris (Gr. *pachys*, thick, and *pteris*, fern).—A genus of fossil ferns chiefly from the lower Oolite, and so named from their thick rigid leaflets. In *Pachypteris* the fronds are pinnate or bi-pinnate, the leaflets entire, without visible veins, having but a single midrib, and contracted at the base.

Pachyspondýlus (Gr. *pachys*, thick, and *spondylus*, vertebræ). — The generic term applied by Professor Owen to certain large sauroid vertebræ, collected by Dr Orpen in the Drakenberg Mountains of Southern Africa, and supposed to be of Triassic Age.

Págodite. — Same as *agalmatolite* or figure-stone; a species of steatite which the Chinese carve into ornamental figures and pagodas, whence the name. (*Poutghad*, house of a god or idol.)

Pagúrus.—The hermit-crab; whose well-known habit of appropriating the deserted shells of whelks and other univalves for the protection of its defenceless abdomen has conferred on it the name. The remains of crabs of apparently similar characters and habits (*Mesostylus*, &c.) are found in the Chalk and Tertiary formations.

Palæchínus, Palæchínidæ (Gr. *palaios*, ancient, and *echinos*, sea-urchin). —A genus and family of Palæozoic sea-urchins or cidarites whose detached plates and long smooth spines occur abundantly in the shales of the Carboniferous limestone. They differ from *Archæocidaris*, with which they are often associated, in their smooth spines and imperforate spiniferous tubercles—there being, as in the Echinus, no perforation for the ligament of the spine.

Palaéocrangon.—Literally "ancient shrimp;" a Permian crustacean of the Zechstein or Magnesian limestone.—See PROSOPONISCUS.

Palæonı́scus.—A well-known genus of ganoid fishes occurring in the Carboniferous and Permian formations. The species, which are numerous, are characterised by their moderate size, elegant heterocercal forms, highly enamelled rhomboidal scales, which in some species are crenulated or serrated on the posterior margins, rather small numerously-rayed fins supported by strong triangular fulcral scales, and jaws furnished with thickly-implanted brush-teeth. *Amblypterus* and *Eurynotus*, at one time associated with *Palæoniscus*, are now erected into separate genera, which see.

Palæontólogy (Gr. *palaios*, ancient; *onta*, beings; and *logos*, reasoning). —Literally, reasoning about ancient beings; that science or subdivision of Geology which devotes itself exclusively to a consideration of the plants and animals found fossil in the crust of the earth.

Palaéophis (Gr. *palaios*, ancient, and *ophis*, serpent).—Literally "ancient serpent;" a provisional genus of serpents whose vertebræ (in several specific forms) have been discovered in the eocene tertiaries of England. The remains of one specimen, from the Bracklesham beds, would indicate a length of about twenty feet, and from the compressed character of its caudal vertebræ, it is supposed to have been of aquatic habits—probably a sea-serpent.

Palæophýtology (Gr. *palaios*, ancient, and *phyton*, a plant).—The science of fossil plants; one of the branches into which it has been proposed to divide the broader science of Palæontology.

Palæosáurus (Gr. *palaios*, ancient, and *sauros*, lizard).—A generic term applied by Dr Riley and Mr Stutchbury to certain reptilian remains (of Thecodont type) discovered by them in the Permian strata, near Bristol. The term has reference to their great antiquity, compared with the reptiles of the Oolite and Weald.—See THECODONTOSAURUS.

Palæóspalax (Gr. *palaios*, ancient, and *spalax*, mole).—Remains of the existing genus *Talpa* (mole) occur in the upper layers of bone-caves and the like; but the generic term *Palæospalax* has been applied to the remains of a closely-allied, if not identical animal, whose jaws and teeth have been found in a lacustrine deposit on the coast of Norfolk, associated with bones of elephant, deer, and beaver, and which must have been as large as a hedgehog.

Palæothérium (Gr. *palaios*, ancient, and *therion*, animal).—A pachydermatous mammal of the eocene tertiaries, which seems to stand intermediate between the rhinoceros, horse, and tapir. About a dozen species have been discovered, varying from the size of a horse to that of a hog; and the bones of the nose show that, like the tapir, they had a short fleshy semi-prehensile proboscis.

Palæóxylon (Gr. *palaios*, ancient, and *xylon*, wood).—Literally "ancient-wood;" a provisional genus erected by Brongniart for the reception of those coniferous-like stems found in the coal-measures, and which are characterised by the presence of thick compound medullary rays—a character unknown in any living conifers. Several of the so-called *Pinites* and *Araucarites* belong to this genus.

Palæozoic, Palæozoic Formations (Gr. *palaios*, ancient, and *zoê*, life).—Applied to the lowest division of stratified groups, as holding the most ancient or earliest known forms of life, in contradistinction to the *Mesozoic* and *Cainozoic*. It includes the Silurian, Devonian, Carboniferous, and Permian systems of British geologists.——In treating of these formations, as developed in the Appalachian chain of North America, Professor H. Rogers has employed a nomenclature which requires explanation—and that explanation will be best given in his own words. "It was found," he says, "that these Appalachian Rocks were far from being sufficiently co-ordinate with the European Palæozoic strata, under their British types, to bear their names; while, on the other hand, the special titles assigned to them in New York were deemed too local and inexpressive, either of their position in the scale of formations, or of their ruling characters, to be usefully applicable. The fifteen formations, or series of deposits, defined by their prevalent organic remains, and by the physical horizons which separate them as sediments, extending from the lowest deposited in the dawn of animal life to those formed at the end of the Coal period, are called by names significant of their relative ages, the words employed suggesting metaphorically the different natural periods of the day. These names are—*Primal*, *Auroral*, *Matinal*, *Levant*, *Surgent*, *Scalent*, *Pre-meridian*, *Meridian*, *Post-meridian*, *Cadent*, *Vergent*, *Ponent*, *Vespertine*, *Umbral*, and *Seral*, meaning respectively the formations of the Dawn, Daybreak, Morning, Sunrise, Mounting Day, Climbing Day, Forenoon, Noon, Afternoon, Declining Day, Descending Day, Sunset, Evening, Dusk, and Nightfall. Some such nomenclature, based on time, is, for many

reasons, preferable to the inexpressive ones which rest for the most part on geographical terms, only locally correct, or on narrow and inconsistent palæontological characters."—See Preliminary Tabulations.

Palæozoólogy (Gr. *palaios,* ancient, and *zoon,* an animal).—The science of fossil animals; one of the branches into which it has been proposed to divide the more general science of Palæontology.

Palágonite (from Palagonia in Sicily).—A peculiar rock-product occurring in connection with modern volcanoes. It is amorphous, of a yellowish-brown colour, glassy resinous lustre, easily broken, and about the hardness of calcareous spar. The *palagonite-tufa* of Iceland consists of 37.42 silica, 11.16 alumina, 14.7 iron peroxide, and 17.15 water, with minor proportions of lime, magnesia, and soda; and is partially soluble by the hot waters of the Geysers.

Palápteryx (Gr. *palaios,* ancient, and *apteryx,* wingless).—An extinct gigantic bird found fossil, or rather *sub-fossil,* in the ancient river-silts of New Zealand; and so termed from its close relationship to the existing *apteryx,* or wingless bird of these islands.

Páleryx.—A provisional genus of serpents from the lower tertiary strata of England, and so named from the apparent affinities of their detached vertebræ (the only relics yet found) to the living *Eryx*—one of the Boa and Python group of ophidians.

Palíchthyólogy (Gr. *palaios,* ancient; *ichthys,* fish; and *logos,* reasoning).—That department of palæontology which treats of extinct or fossil fishes; *e.g.,* the "Palichthyologic Notes" of Sir Philip Egerton in various volumes of the *Quarterly Journal of the Geological Society*—the "*Poissons Fossiles*" of Professor Agassiz, &c.

Palmacítes (Lat. *palma,* the palm-tree). — The general term for any fossil stem, leaf, fruit, or other organism which presents some analogy or resemblance to one or other of the existing palms. Restricted, however, for the most part to simple, cylindrical stems, covered by the bases of fallen petiolated leaves. Remains of palms occur in the Coal-measures, and upwards; but more abundantly and unmistakably in the newer strata.

Paludína (Lat. *palus, paludis,* a marsh).—The "marsh or river snail;" a common, turbinated, whorled univalve, deriving its name from its prevalent habitat being marshes, ditches, or slow-running waters. About sixty species are distributed over the northern hemisphere, and nearly an equal number have been discovered from the Wealden upwards—the well-known Sussex or Petworth marble being almost wholly composed of the shells of *P. fluviorum.*

Pámpas.—In Physical Geography, the vast treeless plains of the Paraguay and La Plata in South America, stretching from the eastern ridge of the Andes to the shores of Buenos Ayres, and thence southwards into the deserts of Patagonia. Though treeless, they are covered with luxuriant herbage—tall grasses and thistles—and are pastured by vast herds of wild cattle and horses.—See PAMPEAN FORMATION.

Pámpean Formation.—The alluvial and comparatively recent deposits that overspread the Pampas of South America. "The Pampean formation," says Darwin, "is highly interesting from its vast extent (an area larger than that of France), its disputed origin (some ascribing its accumulation to debacles, others to the rivers of the country, and others regarding it as an estuary or marine formation), and from the number of extinct gigantic mammifers imbedded in it. It has, upon the whole, a very

uniform character; consisting of a more or less dull reddish, slightly indurated argillaceous earth or sand, often, but not always, including in horizontal lines concretions of marl, and frequently passing into a compact marly rock. These concretions often unite into irregular strata, and cover very large tracts of country. The entire mass consists of a hard, but generally cavernous marly rock (*Toska* or *Tosca-rock*); some of the varieties might be called calcareous tuffs." The formation thus described is extremely uniform in mineral character over the vast area of the Pampas; is regarded by Mr Darwin as having been slowly accumulated at the mouth of the former estuary of the Plata, and in the sea adjoining it; and as having been gradually elevated, like most of the southern latitudes of South America, above the waters of the ocean. It contains shells identical with those still inhabiting the adjacent seas, and is hence considered of recent or pleistocene epoch, though imbedding the remains of numerous mammalia (megatherium, mylodon, glyptodon, toxodon, macrauchenia, &c. &c.) long since extinct, and bearing only a distant affinity to the sloths, armadilloes, ant-eaters, and llamas of the present continent of South America.—See *Darwin's Geological Observations on South America*; the *Zoology of the Voyage of the Beagle*; *D'Orbigny's Voy. dans l'Amerique du Sud*, &c.

Paper-Coal (Ger. *papier-kohle*).—A name given to certain layers of the tertiary lignites, from their papery or leaf-like composition. They are evidently masses of compressed leaves; and when taken fresh from the beds, the venation and reticulations of many of the leaves are quite apparent. Beds of a similar composition, but more obscure in their structure, occur also in the older coal-formations.

Parabátrachus (Gr. *para*, along with, allied to, and *batrachos*, a frog).—A small batrachoid or frog-like reptile whose remains—bones of the head and teeth—have been discovered in the Coal-measures near Glasgow, and described in the *Journal of the Geological Society*, vol. ix., by Professor Owen.

Páraffine, Paraffin (Lat. *parum*, little, and *affinis*, akin).—A well-known hydro-carbon obtained by distillation from petroleum, peat, pit-coal, and other bituminous minerals, and so termed from its remarkable chemical indifference to other substances. When pure it occurs as a tasteless, inodorous, fatty solid of a yellowish-white colour, fusible at 112°, and resisting the action of acids and alkalis. It is now largely prepared in a liquid form (*paraffin oil*), and in a crude state is used for lubricating machinery under the name of *mineral grease*.

Paramóudra.—A vernacular Irish term introduced by Dr Buckland in his account of some gigantic flints, thus popularly named, which occur in the Chalk near Belfast. They are found in other localities, and seem to be gigantic pear-shaped or goblet-shaped zoophytes allied to the sponges, but of so perishable a nature as to have left but few traces of their organisation. They are furnished with a cavity in their broad or upper end which extends downwards into the mass, and the narrow end shows indications of a pedicle by which they were attached to the sea-bottom. They have been found from one to three feet in length, and from half a foot to a foot in diameter.

Paris Basin.—The great area of Tertiary strata on which Paris is situated—often alluded to in Geology, and rendered classic by the palæontological discoveries and inductions of Cuvier. The basin extends about 100

miles from east to west, about 180 miles from north-east to south-west, and has a thickness of several hundred feet of marls, limestones, sandstones, sands, and clays. In descending section these strata present the following characters:—

1. *Upper fresh-water marls*, with interstratified layers of chert, aquatic and terrestrial remains.
2. *Upper marine formation*, consisting of marls, sands, and sandstones, and abounding in marine remains.
3. *Gypseous marls and limestones;* with fluviatile shells and bones of terrestrial animals.
4. *Calcaire Grossier;* alternations of marls, limestones, and calcareous sandstones—the various alternations containing terrestrial, fresh-water, estuarine, or truly marine remains, according to the prevailing agency and conditions of deposit.
5. *Plastic clay and sand*, containing fresh-water shells, drifted wood, lignite, leaves, and fruit; with bands of limestone enclosing marine shells.
6. *Basis* of chalk-flints, broken and partially rolled, and sometimes conglomerated into ferruginous breccia.

Pároxysm, Paroxýsmal (Gr. *paroxysmos*, excitement, exasperation).—Applied in Geology to any sudden and violent effort of natural agency, such as the explosive eruptions of a volcano, or the convulsive throes of an earthquake. Fissures, fractures, and uptiltings of the solid strata are the main indications of *paroxysmal* movements in former ages.

Particles (Lat. *particula*, a little part).—Strictly speaking, the minutest parts or atoms into which matter can be mechanically divided; but generally and loosely applied to the component parts or granules of all solid substances, as "particles of sandstone," "particles of chalk," and the like.

Parting.—Any thin subordinate layer occurring between two main beds, and forming, as it were, a *parting* or line of separation between them. "Partings" of shale are frequent between strata of limestone.

Peach.—The name given by Cornish miners to chlorite and chloritic rocks, generally of a bluish-green colour and soft. A lode composed of this mineral is said to be a *peachy lode.*

Pearlstone.—A variety of felspathic lava composed of a number of globules from the size of a grain of sand to that of a hazel-nut, of a glassy or enamelled aspect and pearly lustre; whence the name.

Peat (Sax.)—Peat, which is a product of cold or temperate regions, arises chiefly from the annual growth and decay of marsh-plants—reeds, rushes, equisetums, grasses, mosses, confervæ, and the like, being the main contributors to the mass, which in process of time becomes crowned and augmented by the presence of heath and other shrubby vegetation. Peat, or Peat-moss as it is often termed, has a tendency to accumulate in all swamps and hollows; and wherever stagnant water prevails there it increases, filling up lakes, choking up river-courses, entombing fallen forests, and spreading over every surface having sufficient moisture to cherish its growth. It occurs in all stages of consolidation, from the loose fibrous "turf" of the previous summer to the compact lignite-looking "peat" formed thousands of years ago. It is sometimes attempted to classify peat as *turf, hill-peat, bog-peat*, &c., according to the situations

in which it occurs, or according to its texture and composition as *fibrous, papyraceous, earthy, woody,* and *piciform;* but seeing that the whole is so irregularly and intimately blended, such distinctions are of little practical value. Geologically, it may be considered as the youngest member of a series of which *lignite, coal,* and *anthracite,* are earlier and more intensified mineralisations. Mineralogically, it constitutes the latest and least metamorphosed of the COAL FAMILY, which see.

Pech-uráne.—Known also as *Pitchblende,* and *uncleavable uranium-ore;* a proto-peroxide of uranium occurring massive and disseminated, also reniform with a curved lamellar structure; colour greyish or brownish-black; easily fractured; lustre imperfect metallic; specific gravity about 7. It is found in the lead and silver mines of Bohemia, and in Saxony, in Cornwall, and in North America. It is the principal ore of uranium; and is used in porcelain-painting, glass-colouring, and the like.

Pecópteris (Gr. *peko,* I comb, and *pteris,* fern).—*Comb-fern.* An extensive genus of fossil ferns occurring abundantly in the Coal-measures, less numerously in the New Red Sandstone and Oolite, and sparingly in Cretaceous and lower Tertiary strata. It derives its name from the regular comb-like arrangement of its leaflets; and is characterised by the leaves being once, twice, or thrice pinnate, and by the leaflets having a perfect mid-rib, from which forked veins proceed more or less at right angles with it.

Pégmatite (Gr. *pegma,* compacted or congealed).—A binary granite composed of quartz and felspar—the felspar crystals lying impacted in the quartz as in a matrix. It occasionally contains flakes of silvery-white mica, and often passes into graphic granite.

Pelágic or **Pelágian** (Gr. *pelagos,* the deep sea).—Formed or deposited in deep water; belonging to the deep sea. Used in contradistinction to *littoral* or *æstuary,* and characterised by a distinct flora and fauna.

Péllicle (Lat. *pellicula,* a very thin membrane or skin).—Applied to any thin covering or coating of extraneous matter; as the nacreous "pellicle" of some shells; the coaly "pellicle" which covers the stems of many fossil plants; and so on.

Pelorosaúrus (Gr. *pelor,* monstrous or unusually gigantic, and *sauros,* lizard).—A term applied by Dr Mantell to one of the huge reptiles of the Wealden—certain vertebræ and other bones indicating a generic difference from the Iguanodon, and other dinosaurs of that formation.

Pentácrinus, Pentácrinite (Gr. *pente,* five, and *encrinus*).—A genus of encrinites abounding in the Lias, Oolite, and Chalk of England, and so termed from the *pentangular* or *five-sided* shape of its supporting column. In this genus, which is still represented by a solitary species in the West India seas, the pieces composing the receptacle are firmly articulated together, and the rays of the disc are fixed immediately to the summit of the column by special ossicles. The receptacle is small, and situated deep between the bases of the arms; it is closed by an integument covered by minute plates or flat ossicles. In many of the plumose pentacrinites the arms are very long and thickly fringed with side-arms and minute pinnæ—all of which are composed of separate articulated ossicles, so that the number of bones in a single endo-skeleton of these crinoids is said to amount to from 50,000 to 150,000 distinct pieces.—See CRINOIDEA and ENCRINITE.

Pentámerus (Gr. *pente,* five, and *meros,* part).—Literally "five-parted," or "five-celled;" a palæozoic brachiopod belonging to the family *Rhynconellidæ,* and occurring characteristically in Upper Silurian and Devonian

strata. The shell is ovate, ventricose, with a large incurved beak; valves usually plaited; foramen angular; no area or deltidium; and differs specially from *Terebratula*, *Rhynconella*, and the like, in having an internal septum or plate by which the cavity is divided into four chambers; and in one valve the septum itself contains a cell—thus making in all five chambers, whence the name *Pentamerus* (five-parted).

Pentremítes (Gr. *pente*, five, and *remos*, a board or plate).—A remarkable genus of Carboniferous crinoids, so termed from the five polygonal plates which compose their pear-shaped receptacle. In the *Pentremite* the column is short, cylindrical, and furnished with irregular side-arms; the receptacle is composed of five polygonal plates, divided by five perforated grooves, which are of a petal-like form, and converge in a rosette on the summit; and from these perforations spring rows of articulated tentacles which are directed upwards over the vertex of the receptacle, apparently for the capture and retention of the animal's food.

Peperíno.—An Italian term for a light porous species of volcanic rock, formed, like tufa, by the cementing together of sand, scoriæ, cinders, &c.; and so called in allusion to the small pepper-corn-like fragments of which it is composed. According to Mr Scrope, the Italian geologists restrict the term *tufa* to felspathic and pumiceous admixtures, which are grey or white, and apply the word *peperino* to the basaltic tuffs, which are usually brown.

Pércolate, Percolátion (Lat. *per*, through, and *colo*, I strain).—Water passing through sand or porous sandstone is said to *percolate* through such a medium; and in such a passage it is filtered or deprived of all mechanically-suspended impurities, as mud and clay; but it is not chemically affected, unless it may have taken up some new ingredient from the strata through which it has percolated.

Pérmeable (Lat. *per*, through, and *meo*, I pass).—Admitting the passage of water; applied to rocks and rock-materials sufficiently porous to permit the passage of water through their pores and interstices.

Permian System.—The lower or palæozoic division of what was formerly regarded as the New Red Sandstone—the term *Permian* having been introduced by Murchison in 1841 (to harmonise with his Silurian and Devonian), from the fact that these strata were typically and extensively developed in the Government of Perm in Central Russia. In that vast and undisturbed region the system consists (according to Murchison) of three main members, which may be arranged in descending order, thus:—

3. Conglomerate and sandstone, with plants and fossil reptiles.
2. Red sands, with copper ore and many plants.
1. Sandstones and grits; limestones in various courses, with characteristic fossils, associated with marls and gypsum, the marls occasionally containing plants, and also seams of impure coal.

In the north of England (more especially in Durham and Yorkshire) it is composed chiefly of red sandstone and grits, of magnesian limestones and gypseous marls, and of laminated calcareous flagstones. This succession is usually tabulated as follows:—

MAGNESIAN LIMESTONE.	LAMINATED LIMESTONE, with layers of coloured marls, as at Knottingley, Doncaster, &c.
	GYPSEOUS MARLS—Red, bluish, and mottled.
	MAGNESIAN LIMESTONE—Yellow and white; of various texture and structure; some parts, as at Tynemouth, brecciated, or made up of fragmentary masses.
	MARL SLATES—Laminated, impure calcareous flagstones of soft argillaceous or sandy nature.

RED SANDSTONE.	RED SANDSTONE, with red and purple marls, and a few micaceous beds. The grits are sometimes white or yellow, and pebbly. When conformable, this sandstone occasionally passes into the coal-measures on which it rests.

In France, Germany, North America, and other tracts where the system has been investigated, some of these members are wanting, while others are more fully and typically developed. It has been attempted to co-ordinate, as in the subjoined synopsis, the English and German strata, taking the north of England and Thuringia as the points of comparison:—

England.	*Germany.*
Laminated limestones.	Stinkstein.
Brecciated limestones.	Rauchwacké.
Fossiliferous limestones.	Dolomit; upper zechstein.
Compact limestone.	Zechstein (mine-stone).
Marl slate.	Mergel-schiefer and kupfer-schiefer.
Red sandstones and grits.	Rothe-tode-liegende.

Palæontologically, the fossils of the Permian system present a decidedly palæozoic aspect—the plants being akin to those of the Coal-measures, together with carboniferous genera of corals, crinoids, shell-fish, fishes with heterocercal tails, and frog-like reptiles. — See NEW RED SANDSTONE.

Petrálogy (Gr. *petra*, a rock, and *logos*, discourse).—Literally, "the science of rocks," and often used synonymously with *Lithology* or *Physical Geology*, which restrict themselves solely to the consideration of rocks and rock-formations, without reference to the organic remains they contain.

Petrified Figs.—The name given by collectors to compressed specimens of the tertiary fruit known as NIPADITES, which see.

Pétrify, Petrifáction (Lat. *petra*, a stone, and *fio*, I become).—Literally, to convert or change into stone. When a shell, bone, or fragment of wood, by being enclosed in calcareous mud or other sedimentary matter, becomes hard and stony, it is said to be *petrified*. Petrifaction is thus caused by the particles of stony matter entering, while in solution, into the pores of the vegetable or animal tissue, and as the organic matter disappears, gradually taking its place, particle after particle, till the whole is converted into stone. The term "petrifactions" is thus often used as synonymous with "fossils" and "organic remains."

Petróleum (Lat. *petra*, rock, and *oleum*, oil).—Literally "rock-oil;" a liquid mineral pitch or bitumen, so called from its oozing out from certain strata like oil. It is usually of a dark yellowish-brown colour, more or less liquid according to external temperature, and consists of 88 carbon and 12 hydrogen. It occurs in various formations, chiefly in connection with fields of coal and lignite, and appears to arise from the decomposition or distillation of these strata by subterranean heat.

Petrophilóides.—Fossil cones, chiefly from the London clay, and so named from their resemblance to those of the existing *Petrophila* of New Holland, which belongs to the natural order Proteaceæ—an order of ever-green shrubs or small trees, with hard dry leaves, and now almost exclusively confined to the southern hemisphere.

Petrosílex (Lat. *petra*, rock, and *silex*, flint).—Literally "rock-flint," in contradistinction to the detached nodular flints of the Chalk formation. A synonym of hornstone, though sometimes applied to the harder kinds of compact felspar, which pass insensibly into hornstone.

Petworth Marble.—A limestone of the Wealden formation, so called from its being worked at Petworth in Sussex; known also as "Sussex marble." It is chiefly composed of shells of the *Paludina* or river-snail, together with cases of *Cypris*, and occasional shells of *Unio, Cyclas*, and other fresh-water genera. It is described by Dr Mantell "as an aggregation of Paludinæ, held together by crystallised carbonate of lime, the cavities of the shells and their interstices being often filled with white calcareous spar."

Peuce, Peucítes (Gr. *peukè*, the fir-tree).—The generic term for all fossil wood that appears absolutely coniferous, in contradistinction to *Pinites*, which only exhibits approximations to the true coniferæ. Both have a central pith, wood in concentric layers, bark, and medullary rays, but with no vessels. In *Pinites*, the cells of the woody fibre are *reticulated;* in *Peucites*, they are marked with oblong deciduous areolæ, having a circle in the middle.—(*Brongniart.*)

Phacops (Gr. *phakè*, a pea or lentil, and *ops*, the eye).—A widely-distributed genus of trilobites, remarkable for the large facets of the eyes, hence the name. In *Phacops*, the trilobation is boldly distinct; the thorax consists of eleven segments; and in some species (*P. caudatus*) the tail is greatly prolonged and pointed.

Phánerite Series (Gr. *phaneros*, evident).—A term employed by Dr Fleming in his *Lithology of Edinburgh* to designate the uppermost stage of the modern epoch, as consisting of deposits produced by causes in ordinary operation, and whose origin is evident, as compared with the brick-clays and boulder-clays (the *Akumite* and *Taragmite* series) which lie beneath. See Modern Epoch.

Phanerogámic, Phanerogamia (Gr. *phaneros*, evident, and *gamos*, marriage).—Applied to those plants whose organs of reproduction (flowers and seed) are apparent, in opposition to the *Cryptogamic*, which have no visible flowers or organs of reproduction.—See Botany.

Phascólomys (Gr. *phaskolos*, pouch, and *mus*, mouse).—Literally "pouched or marsupial mouse;" the wombat of Australia, fossil species of which (*P. gigas*) have been found in the uppermost tertiaries of that country, rivalling the tapir in magnitude.

Phascolothérium (Gr. *phaskolos*, a pouch, and *therion*, animal).—A small marsupial (or pouched) mammal from the oolitic calcareous flagstones of Stonesfield. The jaws and teeth are the only remains yet found, and these seem to indicate an affinity with marsupial genera now restricted to New South Wales and Van Dieman's Land, hence the name.

Phaseolítes (*Phaseolus*, the kidney-bean).—A genus of leguminous plants found in the tertiary fresh-water formation of Aix, having unequally pinnate compound leaves; leaflets entire, disarticulating, with nearly equal reticulating veins.

Phlebópteris (Gr. *phleps, phlebos*, a vein, and *pteris*, fern).—A genus of oolitic ferns, characterised by their pinnæ being in contact with each other at the base, and by their veins (which are simple or forking) being separated from the midrib by a row on each side of hemi-hexagonal *areolæ*, or space destitute of veins.

Phœnicítes.—From *Phœnix dactylifera*, the date-palm; a generic term employed to embrace fossil palm-leaves of the pinnated form, in contradistinction to *Flabellaria*, or those having broad fan-like leaves. *Phœnicites* have been found only in tertiary strata.

Pholádidæ (Gr. *pholeo*, I bore).—The family of boring bivalves, of which the common *pholas* or piddock is the type. In these borers the shell is gaping at both ends, thin, white, brittle, and exceedingly hard; armed in front with rasp-like imbrications; without hinge or ligament, but often strengthened externally by accessory valves. They perforate all substances softer than their own valves, and are found from the Lias upwards.

Pholadomýa (Gr. *pholeo*, I bore, and *mya*, the gaper).—A genus of fossil equivalved shells, with the posterior end short and rounded, and the anterior elongated and gaping. The surface is generally marked with rib-like elevations, diverging obliquely from the beak to the margin. They occur in the Lias, Oolite, and Chalk formations.

Phónolite (Gr. *phonê*, sound, and *lithos*, stone).—A mineralogical term occasionally employed for CLINKSTONE, which see.

Phosphátic Nodules.—A familiar term for those concretions and nodules of phosphate of lime which occur in layers and bands in the gault and upper greensand of the Chalk formation, and which have recently come into use for manurial purposes. They are found abundantly at Farnham in Surrey, at Folkestone in Kent, near Cambridge, and other places; and are evidently of animal origin, being partly coprolitic, and probably the excrement of fishes. Similar nodules and concretions are also obtained from the Crag formation near Felixstow, apparently derived from the waste of the London Clay; and these, it is said, often contain so much as 50 per cent of available phosphate of lime. They are prepared by being ground into powder, and converted into the manurial superphosphate by the action of sulphuric acid.

Phósphorite.—A massive variety of *apatite* or native phosphate of lime, occurring in veins in the crystalline or metamorphic rocks. It contains more fluorine than the crystallised varieties.

Phyllítes (Gr. *phyllon*, a leaf).—A general term for all fossil monocotyledonous leaves in which the principal veins converge at both the base and apex, and are connected by transverse or secondary veins. *Dictyophyllites* are those having a reticulated venation, and, of course, dicotyledonous.

Phyllográpsus (Gr. *phyllon*, leaf, and *grapsus*).—Literally "leaf graptolite;" a lower Silurian organism, known also as *Graptopora*. "It combines," says Mr Salter, "with the shape and general character of the net-like Bryozoa, the texture and the form of the cells of the graptolite, and may be regarded as a bundle of these animals united by processes into a reticulated cup." Some curiously complex branched forms of graptolites, discovered by Sir W. Logan in Canada, complete the chain of affinities between the Graptolites and the Fenestellidæ.

Phytógraphy (Gr. *phyton*, plant, and *grapho*, I write).—Descriptive Botany; the science which describes the characters, habits, distribution, functions, and properties of the vegetable kingdom.

Phytolíthus (Gr. *phyton*, a shoot, and *lithos*).—An old generic term for such stems as *stigmaria*, *favularia*, and the like; used by Martin, Parkinson, Steinhauer, and others.

Phytólogy (Gr. *phyton*, a plant, and *logos*, discourse).—The science of the vegetable kingdom; used as synonymous with *Botany*, hence the term PALÆOPHYTOLOGY, or the science which treats of extinct or fossil vegetable forms.

Phytóphagous (Gr. *phyton*, a shoot or plant, and *phago*, I eat).—Plant-feeding, plant-eating; a term applied to animals which live on vegetables, in contradistinction to those that are *zoophagous*, or prey on the flesh of others.

Pinítes (Lat. *pinus*, the pine-tree).—The generic term for all fossil wood which exhibits structural approximations to the Coniferous order; undoubted coniferous remains being ranked under the term *Peucites*. Remains of both occur in the coal-measures and upwards; but the existing genus *pinus* has not been found earlier than in pleistocene or uppermost tertiary deposits.—See PEUCITES.

Pinnulária (Lat. *pinna*, a feather).—One of Lindley's provisional genera of coal-measure plants, "occurring in small fragments, consisting of a slender stem (or root), from which, at regular distances on opposite sides, spring capillary appendages divided in a pinnated manner." Numerous root-like fragments like *myriophyllites*, *pinnularia*, &c., occur in the coal-measures, but we know little or nothing of their connection or affinities.

Pinus (the *Pine-tree*).—The existing genus *Pinus* has not been found earlier than in Pleistocene deposits; it is readily distinguished by its leaves growing in twos, threes, or fives in the same sheath; and by its cones, which are composed of scales that enlarge at the apex into a rhomboidal disc.

Písiform (Lat. *pisum*, a pea).—Occurring in small concretions like pease; *e.g.*, Pisiform iron-ore.

Pisolite (Lat. *pisum*, a pea, and *lithos*, stone).—Literally "pea-stone;" a concretionary limestone, so called from its resemblance to an agglutination of pease. In "roestone" or "oolite" the component rounded grains or globules are small; in "pisolite," as the name implies, they are considerably larger. These calcareous spherules are composed of concentric laminæ, which commonly have a particle of sand, a fragment of shell, or other organic substance, as a nucleus. They owe their formation to the deposition of successive concretions around the included body while subjected to the action of water in which a rotatory motion is induced; and the spheroids continue to increase until they become too heavy for further transport, and then subside, and are consolidated by subsequent infiltration. The springs near Carlsbad deposit a beautiful pearly-looking *pisolite*, some portions of which are sufficiently compact to admit of being polished and manufactured into boxes and other ornaments.

Pitchstone.—A glassy rock of the trappean division, usually occurring in dykes and disrupting masses; and so called from the pitch-like aspect of its fresh conchoidal and splintery fracture. It is generally black, greyish- or greenish-black; and is occasionally porphyritic (pitchstone porphyry), from the presence of small spherical concretions, termed *sphærulite*. It is classed by mineralogists along with obsidian, pumice, and pearlstone, under the head of *amorphous felspar*—the glassy amorphous nature of these rocks being apparently owing to their rapid cooling from a state of fusion.

Placodérmata, Plácoderms (Gr. *plax*, a plate, and *derma*, skin or covering).—Dr Pander's term for the bony-plated or bone-encased fishes of the Old Red Sandstone—*Coccosteus*, *Pterichthys*, *Cephalaspis*, and the like.

Placoid, Placoídean (Gr. *plax* a plate, and *eidos*, form).—The first order

of fishes in the arrangement of Professor Agassiz. They are characterised by having their skin covered irregularly with plates of enamel, often of considerable dimensions, and sometimes reduced to small points like the shagreen on the skin of many Sharks, and the prickly tooth-like tubercles on the skin of Rays. All the cartilaginous fishes, with the exception of the sturgeon, belong to this order, which includes the skates, rays, dogfish, and sharks.

Plagiaúlax, an abbreviation for **Plagiaulácodon** (Gr. *plagios,* oblique; *aulax,* groove; and *odous,* tooth).—A small herbivorous marsupial, whose teeth and jaws have been found in the Purbeck beds of the Oolite; and so named in reference to the diagonal grooving of the premolars.—FALCONER in *Geological Journal,* vol. xiii.

Plagiostóma (Gr. *plagios,* oblique, and *stoma,* the mouth).—A generic term applied to certain compressed, obliquely-oval bivalves of the Oyster family, which are found fossil from the Trias upwards. They are now ranked under the synonym *Lima,* and partly under *Spondylus,* both of which see.

Planerkalk or **Planerkalkstein.** — Literally "Plain-Limestone;" the German name for the upper member of the chalk formation in Saxony; in contradistinction to the *Bergkalk* or Mountain-limestone. The equivalent in part of our White Chalk.

Planórbis (Lat. *planus,* flat, and *orbis*).—A genus of fresh-water shells distinguished by their discoidal form, the whorls of the shell being coiled up in a nearly vertical plane. There are about sixty living species, and about the same number are enumerated from Wealden and Tertiary strata.

Plaster of Paris.—The familiar designation for the cement or plaster obtained from gypsum or sulphate of lime, and so called from its being first prepared in the neighbourhood of Paris. Gypsum or sulphate of lime, when calcined, is not decomposed (as common limestone is, by parting with its carbonic acid), but simply loses its water of solidification. It is then reduced to a white powder; and when this is again mixed with water, it absorbs a certain portion, and the mass becomes a solid plaster or cement. The white powder is usually sold under the name of "Plaster of Paris," and is largely used in the arts.

Plastic (Gr. *plastikos,* suitable for being wrought or fashioned).—Applied to substances which, like clay, are capable of being fashioned or moulded into any desired form; also to the skill or power of so fashioning; hence we speak of the "plastic art," the "plastic power of nature," and so forth.

Plastic Clay.—"The clays called *Plastic,*" says Lyell, "which lie immediately below the London Clay, received their name originally in France. from being often used in pottery. Beds of the same age (the Woolwich and Reading series of Prestwich) are used for the like purpose in England." As a series the Plastic Clay of England constitutes the middle portion of the Eocene group, and consists of plastic or mottled clays and sands, and well-rolled flint pebbles. It is partly of marine and partly of fresh-water formation, and is characterised by two species of oyster (*O. bellovacina* and *edulina*), and some fresh-water shells, as *Melania, Cyrena, Unio, Paludina,* &c. It is the equivalent of the French *Argile Plastique et Lignite.*"

Platýcrinus, Platycrinite (Gr. *platys,* broad).—A genus of encrinites

peculiar to the Carboniferous limestone, and so termed from the flatness and breadth of the basal and radial plates of the receptacle.

Platysómus (Gr. *platys,* broad, and *soma,* body).—One of the pycnodonts; a ganoid fish of the Carboniferous and Permian epochs, and so called from its deep bream-like body, which is covered with strong rectangular scales arranged in bold transverse rows. Head rather small; eye-orbits large; tail sharply heterocerque.

Plesiosáurus (Gr. *plesios,* near to, and *saurus,* a lizard).—A genus of marine reptiles (of which there are known about twenty species), occurring from the Lias to the Chalk inclusive; and so named from its being much more lacertilian in structure than the ichthyosaurus, from which it differs in the smallness of the head, the enormous length of neck, which consists of from twenty to forty vertebræ, and in other osteological peculiarities. "This reptile," says Mantell, "combines in its structure the head of a lizard, with teeth implanted in sockets like the crocodile—a neck resembling the body of a serpent—a trunk and tail of the proportions of those of a quadruped—with paddles like the turtle. The vertebræ are longer and less concave than in the ichthyosaurus; and the ribs being connected by transverse abdominal processes, present a close analogy to those of the Chameleon." Specimens have been found, and some of them almost entire, ranging from ten to twenty feet in length.—See ICHTHYOSAURUS.

Pléistocene (Gr. *pleistos,* most, and *kainos,* recent).—Literally, "most recent;" that is, the most recent or uppermost of the Tertiaries, a term implying that the organic remains in such accumulations belong almost wholly to existing species. Sir Charles Lyell makes use of the word *Post-Pliocene,* and others employ the term *Pleistocene* as equivalent to *Post-Tertiary;* but, properly speaking, the organic remains of the post-tertiaries belong exclusively to species still existing, while those of the pleistocene embrace a few extinct forms. As it is impossible to draw sharp lines of demarcation between different formations, the *Pleistocenes* may be regarded as the passage-beds between Tertiary and Post-Tertiary formations.

Pleuracánthus (Gr. *pleuron,* the side, and *acantha,* a thorn or spine).—A genus of ichthyodorulites or fin-spines occurring in the Carboniferous formation, and characterised by their having a row of sharp hooks or denticles on either side; whence the name. According to Agassiz, they belong to the fossil family TRYGONIDÆ.

Pléurodont (Gr. *pleuron,* the side, and *odous,* tooth).—A term applied by Professor Owen to those inferior or squamate saurians which have the teeth anchylosed to the bottom of an alveolar groove, and supported by its side. —See THÉCODONT.

Pleurotomária (Gr. *pleuron,* a side, and *tomê,* a notch).—An extensive genus of fossil shells belonging to the gasteropod family *Haliotidæ,* and comprising about 400 species, which range from the Lower Silurian to the Chalk inclusive. The shell resembles that of the *Trochus,* is solid, few-whorled, and has its surface variously ornamented—the colour being still preserved in some specimens; the aperture is somewhat square, and has a deep slit in its outer margin; hence the name. The part of the slit which has been progressively filled up forms a prominent band round the whorls. "In this extensive group," says Woodward, "there are some species which rival the living turbines in magnitude and solidity, whilst others are as frail as ianthina."

Plíocene (Gr. *pleion,* more, and *kainos,* recent).—Sir Charles Lyell's term

for the upper tertiaries as containing *more*, or a greater per-centage, of recent testacea than the miocene or eocene. In 1830, according to the enumeration of M. Deshayes, the per-centages were, *Pliocene*, 35 to 50; *Miocene*, 17; and *Eocene*, only 3½. In the "Newer Pliocene" or uppermost tertiaries of Lyell (the *Pleistocene* of many authors) the per-centage increases to 90 or 95.

Pliólophus (Gr. *pleion*, more, and *lophion*, a small crest).—A small *lophiodont* mammal, whose remains have been found in eocene and miocene tertiaries, and so named by Professor Owen because it seems to be *more near* to the lophiodont type than its close ally the *hyracotherium*.—See LOPHIODON (*Jour. Geol. Soc.*, vol. xiii.)

Pliopithécus (Gr. *pleion*, more, and *pithecos*, ape).—An extinct ape from the miocene deposits of the south of France, and so named by Gervais from its resemblance to the tailed monkeys (*semnopithecus*) of Southern Asia.

Pliosáurus (Gr. *pleion*, more, and *sauros*, lizard).—A marine reptile of the upper Oolites, intermediate in structure between the Plesiosaur and Ichthyosaur; literally "more lacertilian" than the common ichthyosaurus. With the exception of the teeth, which are thicker and stronger, the vertebræ of the neck, which are short and compressed, and the more massive proportions of the jaws and paddle-bones, the framework of *pliosaurus* closely accords with that of *plesiosaurus*.

Plumbágo (Lat. *plumbum*, lead).—One of the names given to Graphite or Black-lead, from its resemblance to an ore of lead. –See GRAPHITE.

Plumbíferous (Lat. *plumbum*, lead, and *fero*, I yield or bear).—Applied to veins, strata, or other matrices yielding or containing any of the ores of lead.

Plum-pudding-stone.—Originally applied to a very pretty conglomerate of flint pebbles cemented together by a siliceo-calcareous matrix, polished sections of which had a fanciful resemblance to the fruit in a slice of plum-pudding,—now loosely applied to all conglomerates.—See PUDDING-STONE.

Plutónic (*Pluto*, the god of the inferior regions).—Applied to igneous rocks found at some depth beneath the surface of the land or sea, as distinct from *Volcanic*, or those thrown up to, and consolidated on the surface. As a class, the Plutonic are more crystalline, and exhibit more structure than the Volcanic—characteristics apparently induced by the greater pressure under which they were cooled and consolidated.

Plúvial (Lat. *pluvius*, rainy).—Of or belonging to rain; applied to operations and results that arise from or depend on the action of rain. Thus we speak of the denuding or degrading effects of "pluvial agency," just as we speak of "atmospheric," "fluviatile," or other similar agency.

Poacítes (Lat. *poa*, the meadow-grass).—The generic term for all fossil monocotyledonous leaves, the veins of which are parallel, simple, of equal thickness, and not connected by transverse bars. In the mean time *Poacites* takes rank under the *Gramineæ* or grasses, though, from the great length and breadth of many of the Coal-measure species, it is more than probable that some of them may be the leaves of pinnated palms.—See PHYLLITES.

Podosphénia (Gr. *pous*, *podos*, the foot, and *sphen*, a wedge).—A genus of Diatoms or microscopic plant-growths, deriving their name from their wedge-shaped frustules, which in youth are attached by the small end, but afterwards become free. They are said to be chiefly marine, and abound in the polishing-slate of Bilin.

Poikilític or **Poecilitic** (Gr. *poikilos*, variegated).—A term applied by the

earlier English geologists to the upper New Red Sandstone, in allusion to the variegated colours—red, green, purplish, &c.—of its marls and sandy shales. The *bunter sandstein* of the Germans; the *terrain pœcilien* of the French.

Polierschiefer (Ger.)—Polishing-slate; a slaty infusorial or rather microphytal rock, the same as the *tripoli* of Bilin, &c., and so termed from its being used as a polishing powder.

Pollux.—Castor and Pollux, two closely allied minerals of the Felspar family; hence their names by Breithaupt. They resemble quartz in their hardness, transparency, and vitreous lustre, and are the most siliceous of the crystalline silicates.

Polypárium (Lat.)—The common framework or endo-skeleton of any group of polypes; the secreted matter by which they are united into one colony, whether fleshy, horny, calcareous, or siliceous.—Same as *Polypidom*, which see.

Pólypes, Polypi (Gr. *polys*, many, and *pous*, foot).—The zoological term applied to those radiated animals which are furnished with many tentacula or foot-like organs of prehension surrounding the mouth or free orifice; as the "fresh-water polype" or hydra, the "coral polype," &c.—See ZOOPHYTA.

Polýpidom (*polype*, and *domus*, a house).—A name given to the stems and permanent fabrics of zoophytes, around or in which are placed the little cells containing the polypes or animals which construct the mass. In some the polypidom is horny and flexible like the *gorgonia* or sea-fan; in others, as the common madrepore *coral*, it is strong and calcareous; and in others it is membrano-calcareous. In the stony or lime-secreting genera this endo-skeleton, polypidom, polyparium, or common support, becomes the well-known *Coral*, the aggregation of which constitutes those vast *Reefs* that rival in magnitude the limestones of the earlier formations.

Polyporítes.—Literally "many pores;" the name given by Dr Lindley to a fungus-like organism from the Coal-measures of Wales, from its resemblance to the existing *Polyporus versicolor*.

Polythalámia (Gr. *polys*, many, and *thalamos*, a chamber).—An order of compound Protozoa, so called from their being enclosed in calcareous shells consisting of a series of distinct chambers. These chambers in some species communicate with each other; in others they are completely closed up, and appear to be the abode of a separate and probably independent animal. The general belief, however, is, that the several cells or portions of the vitalised mass communicate in some way or other with each other, so as to maintain the simultaneous vitality of the whole. In some instances each chamber of the common shell presents only a single *external* opening; but as a general rule the substance of the shell is pierced like a sieve, with numerous minute pores or *foramina* for the protrusion of delicate filaments; hence the term FORAMINIFERA. All the Polythamia are marine, and frequently occur in such numbers that the fine calcareous sand of the sea-shore and sea-bottom is entirely made up of their microscopic shells. In former ages they appear to have been even more abundant; and thus the Chalk, as well as many of the marls and limestones of the Tertiary epoch, are in a great measure composed of their remains—partly entire, and partly worn and broken by the action of the waves. As an order, the Polythalamia have been divided into several families, characterised by the arrangement of the chambers constituting the compound

shell; and nearly two thousand species have been enumerated—a number that, in all likelihood, will be greatly reduced, as more minute investigation shows that many of these so-called species are only forms of the same animal in various stages of development.

Polyzóa (Gr. *polys*, many, *zoa*, animals).—This term embraces all the minute mollusca which inhabit compound phytoidal structures like the *flustra* and *retepora*, and which were till lately confounded with the polypes or corallines. The term was introduced by Mr J. V. Thompson in 1830, and is now generally adopted in preference to *Bryozoa*, the name subsequently employed by Ehrenberg. "The Polyzoa," says Professor Allman in his monograph on the fresh-water genera, "are chiefly inhabitants of the sea, where they may be witnessed under numerous plant-like guises; now spreading like a lichen over submerged stones or old shells, or broad fronds of laminaria and other sea-weeds; now forming soft, irregular, fungus-like masses, or hard calcareous branchy growths, like diminutive trees; and now again presenting the appearance of the most delicate and exquisitely-formed sea-weed or moss, offering even to the unassisted eye, in the endless repetition of the same element of form, objects of surpassing symmetry and beauty. The Polyzoa, however, are not by any means exclusively confined to the ocean; and though by far the greater number are marine, yet in the still and running waters of the land—in the broad river and rushing stream—in the pure cold mountain lake, and the stagnant waters of the mossy fen—species are to be found, which in interest yield not one jot to their brethren of the sea, and offer to the naturalist an inexhaustible source of gratification, in the beauty of their forms and the wonders of their organisation." They are found fossil as well as recent, and occur in all formations from the Cambrian and Silurian upwards—*e.g.*, *Oldhamia*, *fenestella*, *retepora*, *eschara*, *flustra*, &c. To distinguish the inhabitant of the polyzoan cell from the true polype, the term *polypide* has been proposed; and the entire structure is known as the *Cœnœcium* or "common dwelling," in contradistinction to the polypary or polypidom of the polype.

Ponent (Lat.)—Laying aside; the twelfth of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain —the "Sunset" of the North American palæozoics, and the equivalents of our Upper or true Old Red Sandstone.—See Palæozoic Formations.

Porcellanite.—Known also as "porcelain jasper" and "burnt earth." The term applied to clays and shales that have been converted by subterranean heat into jaspery or porcelain-like masses of various colours and hardness, according to their original composition, and the degree of heat to which they have been subjected. Frequent in the vicinity of dykes and erupted traps.

Porífera.—In modern systems of Zoology, the second class of Protozoa, including the sponges; and so called from the masses formed by these creatures being perforated in every part with minute orifices. Literally "pore-bearing." Sponge, as we usually see it, consists of a congeries of horny filaments, interlacing in every direction, so as to form an intricate network of intercommunicating cells; and imbedded in these filaments, in the most of sponges, are needle-shaped particles of siliceous or calcareous matter termed *spicula*. The animated portion is a mere mucilaginous investment composed of an aggregation of cells. Fossil sponges occur in several formations, and especially in the Chalk of England.

Pórphyry (Gr. *porphyreos*, purple).—This term was originally applied to a reddish igneous rock found in Upper Egypt, and used for sculptural purposes; a red syenitic porphyry. It is now employed by geologists to denote any rock (whatever its colour) which contains imbedded crystals distinct from the main mass or matrix, though, strictly speaking, it ought to be restricted to those having a felspathic basis. We have thus felspar porphyry, claystone porphyry, porphyritic granite, and porphyritic greenstone.

Porphyrític.—Having the aspect or texture of porphyry; as the "porphyritic granite" of Devon and Cornwall, which contains large prismatic crystals of felspar; the "porphyritic gneiss" of Portsoy, which imbeds in its folia large irregular crystals of felspar; or "porphyritic greenstone," which has often large crystals of hornblende scattered confusedly through its mass.

Portland Cement.—A well-known cement, largely used for facing-up brick-buildings, &c., in imitation of stone. It is made from carbonate of lime (common limestone) mixed with great care, in definite proportions, with the muddy deposits of rivers running over clay and chalk. The whole of the materials are carefully pounded together under water, and are afterwards dried and calcined.—See Cements.

Portland Stone and **Portland Sand.**—A well-known group of the upper oolite as developed in the south of England. It consists of shelly freestones of variable texture underlaid by thick beds of sand, and derives its name from the Isle of Portland in Dorsetshire, where certain of the freestones have for centuries been largely quarried for architectural purposes. The Portland beds abound in fossil shells, bones of saurians, and drift coniferous wood.—See Oolitic Formation.

Post— (Lat.)—A frequent prefix in scientific compounds signifying *after*, either in regard to time or position; as *post-meridian*, after mid-day; *post-tertiary*, later or younger than the tertiary formation; *post-abdominal*, placed immediately behind the abdomen; after-abdominal.

Post-Meridian (Lat.)—After mid-day; afternoon; the ninth of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain — the "Afternoon" of the North American palæozoics, and the equivalent in part of our Lower Devonians.—See Palæozoic Formations.

Post-Tertiary System.—Under the term *Post-Tertiary* it is usual to arrange all accumulations and deposits that have been formed since the close of the Boulder-Drift or Glacial period—regarding that epoch as the true termination of the Tertiary System. However difficult it may be to account for the conditions that give rise to the "Drift," there can be no doubt regarding the agencies which have been at work ever since in silting up lakes and estuaries, forming peat-mosses and coral-reefs, and laying down beaches of sand and gravel. At the close of the Pleistocene period, the present distribution of sea and land seems to have been established—at least in the northern hemisphere—the land presenting the same surface configuration, and the sea the same coast-line, with the exception of such modifications as have since been produced by atmospheric, aqueous, and other obvious causes. At the close of that period the earth also appears to have been peopled by its present Flora and Fauna, with the exception of some local removals of certain animals, and the general extinction of a few species, whose remains are found imbedded in a partially petrified or *sub-*

fossil state in post-tertiary accumulations. We are thus introduced to the existing order of things; and though our observations may extend over a period of many thousand years, yet every phenomenon is fresh and recent compared with those of the preceding epochs. With the exception of volcanic lavas, deposits from calcareous and siliceous springs, some consolidated sands and old coral-reefs, we have now no solid strata—the generality of post-tertiary accumulations being clays, silts, sands, gravels, and peat-mosses. Arranging these in chronological order, it is usual to speak of them as *Post-Glacial, Pre-Historical,* and *Historical*—the full imports of which will be readily understood by referring to the preliminary tabulation of "Contemporary or Equivalent Deposits."

Potamophyllítes.—Literally "river-leaves" (Gr. *potamos*, river, and *phyllon*, leaf); a genus of monocotyledonous leaves occurring in fresh-water tertiaries; now ranked under the more general term PHYLLITES.

Potato-stones.—A quarryman's term for the *geodes* of the mineralogist; rounded irregular concretions of various composition, often hollow and lined with crystals, or containing earthy detached nuclei.

Poteriócrinus, Poteriocrinítes (Gr. *poterion*, a goblet, and *encrinus*).—An extensive genus of encrinite occurring in the carboniferous limestones of Britain and Ireland; and so called from the vase or goblet shape of its body or receptacle, which is composed of three series of angular plates—five in each series.

Potstone.—A soft magnesian or talcose rock, sectile, and capable of being fashioned into pots and vases; the *lapis ollaris* of the ancients. Mineralogically, it is an uncertain mixture of talc, chlorite, mica, asbestus, and the like, occurring in beds among the crystalline rocks of various countries.

Pozzuolána or **Pozzolána** (From Pozzuoli in the Bay of Naples).—A volcanic ash or sand largely used in the manufacture of Roman cement. The artificial mixture consists of fine volcanic powder, charged with about 20 per cent of oxide of iron, and the addition of a little lime. It forms one of the best of our hydraulic cements, setting and solidifying rapidly under water.

Precession of the Equinoxes.—"The earth's axis," says Mr Hopkins, in treating of this subject, "is at present directed to a point in the heavens near to the star *Polaris.* This point is the exact north pole of the heavens; and in considering it with reference to periods of time not exceeding many years, we usually speak of it as *a fixed point.* This, however, is not strictly correct. The pole moves very slowly, so as to describe very nearly what is called a *small circle* in the heavens. This small circle, and the motion of the pole along it, are such, that in 12,000 or 13,000 years the pole will be distant from the present pole by more than 40°; but, in some 25,000 years, it will have returned to the point in the heavens which it now occupies. Thus we see that the present distinction enjoyed by Polaris is but a transitory one, which in a few centuries will pass away, with the certainty, however, of returning after the period just mentioned. A further reference to the celestial globe will immediately show that this motion of the earth's axis or pole will necessarily superinduce a corresponding motion of the equinoxes along the ecliptic. This motion is about 50″ a-year, and is in a direction opposite to that in which the signs of the Zodiac are reckoned; and consequently the sun, after leaving either equinox, returns to it again in less time (by about twenty minutes) than if

the equinox had remained stationary. This is *the precession of the equinoxes.*"

Precípitate (Lat. *præcipito,* I cast headlong).—When substances held in solution are made to combine chemically, or are otherwise changed, so as to fall to the bottom in a solid state, they are said to be *precipitated,* or to form *precipitates.* Substances in mechanical suspension merely, and falling to the bottom by their own gravity, are, on the contrary, said to form *sediments.*

Pre-Meridian (Lat.)—Immediately before mid-day; the seventh of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain; the "Forenoon" of the North American palæozoics, and the equivalent apparently of our upper Silurians.—See PALÆOZOIC FORMATIONS.

Primal (Lat.)—The first or earliest; the lowest of the fifteen series into which Professor Rogers subdivides the palæozoic rocks of the Appalachian Chain; the "Dawn" of the North American palæozoics; and the equivalent, perhaps, of our lowest Cambrians.—See PALÆOZOIC FORMATIONS.

Primitive or **Primary Rocks** (Lat. *primus,* first).—Under this term the earlier geologists included all the crystalline deep-seated rocks (granite, gneiss, mica-schist, clay-slate, &c.), as having been formed in the "primæval" ocean, or contemporaneously with the globe itself, and before the creation of Life, as none of them enclose the remains of plants or animals. As general designations for the older rocks, the words *primary* and *primitive* are still retained, though it is now well known that granite and crystalline strata are found of all ages and in all formations. The term may be regarded as synonymous with the *Azoic, Hypozoic, Metamorphic,* or *Non-fossiliferous* systems of modern geologists.

Primórdial (Lat. *primus,* first, *ordo,* in order).—A term used by M. Barrande for the lowest or earliest zone of fossiliferous strata, more especially as developed in Bohemia, the field of his principal labours. May be regarded as the equivalent of the *Cambrian system* of Professor Sedgwick.

Pristacánthus (Gr. *pristis,* a saw, and *acantha,* spine).—Literally "saw-spine;" a genus of ichthyodorulites or fin-spines found in the Oolite, and supposed to belong to fishes of the Cestraciont family.

Pristis (Gr.)—The saw-fish; a well-known predatory fish allied to the Rays and Sharks, and remarkable for its long, flat, bony beak, which is armed on either side (like a saw) with sharp compressed teeth, the whole constituting a most formidable weapon, offensive or defensive. The beaks or "saws" of extinct species occur in the tertiary beds of England and the Continent.

Prodúcta, Prodúctus (Lat., produced, drawn out).—A well-known genus of brachiopodous molluscs, occurring abundantly in Devonian, Carboniferous, and Permian strata, and so termed from their long, straight, hinge-line, which extends considerably (produced) beyond the breadth of the valves. The Producta has been taken as the type of the family *Productidæ,* in which the shell is concavo-convex, with a straight hinge-line, valves rarely articulated by teeth, closely appressed, furnished with tubular spines; ventral valve boldly convex; dorsal concave; internal surface dotted with conspicuous punctures: *dorsal* valve with a prominent cardinal process; brachial processes sub-central; vascular markings lateral, broad, and simple; adductor impressions dendritic, separated by a narrow central ridge: *ventral* valve with a slightly notched hinge-line; adductor

scar central, near the umbo; cardinal impressions lateral, striated. The Productidæ are highly characteristic of the carboniferous limestone, occurring in many species, and in all stages of growth and aggregation; hence the frequent term "Productus Limestone."

Prosoponíscus (Gr. *prosopon*, a face or mask, and *oniskos*, wood-louse).—A Permian cretacean, apparently belonging to the family of Isopods, and found in the Zechsteins of Germany and magnesian limestones of Durham. So named by J. W. Kirkby, who objects to Schauroth's term "*Palæocrangon*," as not expressing the true affinities of the species.

Prótogine (Gr. *protos*, first, and *ginomai*, I am formed).—The French term for a granite composed of felspar, quartz, and talc; *talcose granite*. It abounds in the Alps, in Cornwall, and other countries, and derives its name from the erroneous idea that it is the oldest or *first-formed* of the granites. The *Kaolin* or China-clay of Cornwall is chiefly derived from its decomposition.

Protórnis (Gr. *protos*, first, and *ornis*, bird).—Literally "first bird;" the most ancient example as yet known of a passerine fossil bird. It occurs in the eocene tertiaries of Glaris, is about the size of a lark, and in some respects similar to that bird.

Protorosáurus or **Protosaurus** (Gr. *proteros*, earlier, the first, and *saurus*, lizard).—"The fossil monitor of Thuringia;" so called from its occurring in the bituminous copper-slate of Thuringia, and for a long time the earliest reptile known to geologists; hence the term *Protosaurus*.

Prótotype (Gr. *protos*, first, and *typos*, a type or mould).—The original form after which others are fashioned or moulded; the original from which others are copied; the primary form to which others, in their principal features or characteristics, bear resemblance. Often loosely and variously applied.

Protozóa (Gr. *protos*, first, and *zoè*, life).—In modern systems of classification, the *first* or lowest division of the animal kingdom. It includes a number of creatures of a very lowly type of organisation, which appear almost to occupy a sort of neutral ground between animals and vegetables —the function of reproduction being principally performed by a plant-like budding or division of the parental substance. The bodies of the Protozoa consist either of a simple elementary cell, or of an aggregation of cells, each cell being capable of a separate and independent existence. Some are simply gelatinous; others secrete a horny, calcareous, or siliceous investment; and most of them are of microscopic size. The Division embraces three classes:—1. The *Rhizopoda*, whose organs of locomotion consist of mere root-like expansions of the body itself; 2. The *Porifera*, or sponges; and 3. The *Infusoria*, or infusory animalcules: or, more minutely, according to other systematists,—1. *Rhizopoda*; 2. *Polycystina*; 3. *Spongidæ*; 4. *Thalassicollidæ*; 5. *Gregarinidæ*; and, 6. *Infusoria*.—See the respective classes.

Protozóic (Gr. *protos*, first, and *zoè*, life).—First-life; belonging to, or containing, the first traces of life. Applied to the earlier fossiliferous epoch and strata; equivalent to Primordial; hence such phrases as "protozoic zone," "protozoic world," &c.

Psámmite (Gr. *psammos*, sand).—A term in common use among Continental geologists for fine-grained, fissile, clayey sandstones, in contradistinction to those which are more siliceous and gritty (*grès*).

Psámmodus (Gr. *psammos*, sand, and *odous*, tooth).—Literally "sand-

tooth;" a provisional genus of cestraciont teeth from the carboniferous limestone, and so called from their granular or rough upper surface used for crushing and grinding. They are generally of a quadrangular form, and of large dimensions.

Psarolítes or **Psaronítes** (Gr. *psaros*, speckled, and *lithos*).—The name given to the silicified stems of Tree-ferns found so abundantly in the New Red Sandstone near Hillersdorf in Saxony, in allusion to the stellated markings produced by sections of the vessels that compose the tissues. From this speckled appearance, which is visible to the naked eye, these fossils have also obtained the popular name of *Staarein-stein* or *Star-stone.*

Pseudo— (Gr. *pseudes*, false).—A prefix of frequent occurrence in scientific compounds, and implying something deceptive in appearance, function, or relation; as *Pseudo-pods,* those protozoans which have the power of thrusting out the fleshy substance of their bodies into feet-like organs or processes (literally "false-feet"); *Pseudo-carps, Pseudo-bulbs,* and the like.

Pseudomórphous (Gr. *pseudes,* false, and *morphè*, form).—Applied to substances which, not possessing a crystalline structure, are yet found in the form of regular crystals. Such *pseudo-morphic crystals,* as they are termed, are evidently moulded in cavities from which original regular crystals have been dissolved—the new substances, particle by particle, taking their place.

Psilómelane (Gr. *psilon,* smooth, and *melan,* black).—Uncleavable manganese ore; a mixture of the protoxide and hyperoxide of manganese, with impurities of baryta, silica, potash, and water. It usually occurs in botryoidal, kidney-shaped, or stalactitic masses, having a smooth surface, foliated texture, and dark glistening colour; whence the name. It is generally found along with other ores of manganese in veins in the older or crystalline rocks.

Pteríchthys (Gr. *pteron,* wing, and *ichthys,* fish).—Literally "winged-fish;" a characteristic bone-encased fish of the Old Red Sandstone, deriving its name from two wing-like lateral appendages, which seem to have been used both as organs of motion and defence. Like the living *Ostracion* or trunk-fish, the *Pterichthys* was encased in a framework of bony plates, leaving only the caudal portion free, and this seems to have been covered with rounded enamelled scales, and furnished with a vertical sailing-fin. The osteology and organs of the Pterichthys are yet but imperfectly known.

Pterinéa (Gr. *pteron,* a wing).—A sub-generic form of the *Avicula* or wing-shell, occurring in palæozoic strata, and characterised by their thick, rather inequivalve, very oblique, and broadly-winged shells, which have the beaks anterior, sinus shallow, and hinge-area long, straight, narrow, and striated lengthwsie.

Pterodáctyle (Gr. *pteron,* wing, and *daktylos,* finger).—Literally "winged-finger;" a genus of flying reptiles, several species of which have been discovered in the Lias, Oolite, Wealden, and Chalk formations of Europe. "With a long-snouted head and long neck," says Mantell, "much resembling that of a bird, bat-like wings, and a small trunk and tail, with lacertian affinities in its skull, teeth, and skeleton, and with a bird-like structure of sternum and scapular arch, these creatures present an anomaly of structure as unlike their fossil contemporaries as the duck-billed Ornithorhynchus of Australia to existing mammals. The cranium is small; the

jaws are long, and either armed with numerous sharp-pointed teeth, or toothless like those of a bird. The eye-orbit is very large; the sclerotica consists of a ring of bony plates, and the nostrils are placed near the orbits. The cervical vertebræ are large and strong, and capable of great flexibility backwards and forwards, probably to allow the head to fall back to the centre of gravity during flight. The dorsal vertebræ are from seventeen to twenty in number. The sacrum is formed by the coalescence of two vertebræ only, as in existing reptiles, and not of many, as in birds and certain extinct saurians. The tail is generally short, an unusual character with saurians; but a species with a long tail occurs at Solenhofen. There are five toes or digits on each foot; the outer finger of the fore-arm is immensely elongated for the support of a membranous expansion (the impression of which is preserved in some instances); and the other digits of fore and hind feet terminated in long curved claws. The size and form of the extremities show that the *Pterodactylus* was capable of perching on trees, of hanging against perpendicular surfaces, and of standing firmly on the ground, when, with its wings folded, it might crawl on all fours, or hop like a bird." Restorations of the pterodactyle have been attempted by Mr Hawkins at the Crystal Palace; and ample details are given by Dr Buckland (*Bridgewater Treatise*); by Owen (*Monograph Palæontogr. Soc.*); by Von Meyer (*Palæontographica*); and by other authorities.

Pterophýllum (Gr. *pteron*, a wing, and *phyllon*, leaf).—Literally "wing-leaf;" a genus of cycadaceous leaves, chiefly from the lias and oolite. Like ferns, they are pinnated, but are readily distinguished by their greater substance, thicker midrib, and especially by *their veins being in all cases undivided;* that is, never forking or dichotomising as in ferns.—See CYCADITES.

Pterópoda (Gr. *pteron*, a wing or fin, and *pous, podos*, a foot).—Literally "wing or fin-footed;" a class of encephalous molluscs, consisting of small, floating marine animals like the *clio* and *hyalæa*, that swim by the alternate expansion and contraction of two lateral appendages, whence the name. Their inversely-pyramidal, transversely-striated, fragile shells, occur in all formations—*e.g., theca, pterotheca, conularia*, &c.

Pterosáuria (Gr. *pteron*, wing, and *sauros*, lizard).—Literally "winged-lizards;" a group or order of extinct saurians, organised, as the name implies, for an aërial existence, and embracing such forms as *Pterodactylus, Ramphorhynchus*, &c.—See tabulations, "ANIMAL SCHEME."

Pterygótus (Gr. *pteron*, wing, and *ous, otos*, ear).—A gigantic crustacean, belonging to the fossil family *Eurypteridæ*, and occurring chiefly in the "passage beds" between the Silurian and Devonian systems. It receives its name from the peculiar shape of its detached mandibular or jaw-feet, which from their scale-like sculpture were at first mistaken by Agassiz for the remains of some fish. As yet the species of Pterygotus have been found only in the lower flagstones or tilestones of the Old Red in Forfar and Hereford shires, and in the upper Silurians of Lesmahagow and Ludlow —strata which, for this marked characteristic, may not unappropriately be termed the "Pterygotus beds" of Great Britain. In general aspect the Pterygotus may be described as a gigantic "lobster-like crustacean," inasmuch as it has an elongated form, composed in the main of a cephalo-thorax, an abdominal portion consisting of several segments, and a telson or tail-plate. This, however, is the utmost of the similitude, the genus, like the family, partaking of characters which appertain to several existing

orders—Copepods, Pœcilipods, and others. Thus taking Pterygotus in its *dorsal aspect*, we are presented with a somewhat oblong cephalo-thorax or carapace having two large compound eyes placed on the anterior margin; an abdominal region or main portion consisting of eleven segments, which gradually swell out in width till the fifth or sixth, and then gradually narrow and elongate towards the tail; and a telson or tail-plate somewhat oval, and tapering to a point like an old Roman spear-head. In the *abdominal aspect* the tail and all the abdominal segments are void of limbs or other appendages; and the limbs or organs of motion are all attached to the under-side of the carapace, as in the Limulus or King-crab. There are three or four pairs of such limbs—the first five-jointed, long, chelate, and pincered like those of the lobster; the second pair also five- or six-jointed, and simply pointed; and the third pair broad, and terminating in a palette-like paddle for oaring or swimming. The oral apparatus consists, as in the King-crab, of the serrated basal-joints of these limbs, the whole being protected by a heart-shaped breast-piece or metastome. The vent and genital apparatus are placed forward on the first and second under-segments, which separate into several pieces—the separation being protected by a duck-bill-like plate, which differs in shape in the different sexes. The whole exterior surface of the crust, which seems to have been calcareo-coriaceous rather than hard-calcareous, is ornamented by a peculiar scale-like sculpture, which becomes beaded and serrated on the free margins, whether in the carapace, abdomen, or telson.—See EURYPTERIDÆ.

Ptilodictýon (Gr. *ptilon*, a plume or feather, and *dictyon*, a net).—Literally "feather-net;" a genus of Silurian polyzoans apparently allied to the living *Eschara* of our coasts, and so termed from its flat, branching, feather-like aspect.

Ptychóceras, Ptychoceratite (Gr. *ptychè*, a fold).—A genus of chambered shells of the Ammonite family, peculiar to the cretaceous formation, and so named from the shell, which is bent or folded upon itself, the two straight portions being in contact.

Ptýchodus (Gr. *ptychè*, a fold or wrinkle, and *odous*, tooth).—Literally "wrinkle-tooth;" a genus of Cestraciont fish-teeth, found in almost every chalk-pit, and occasionally in conjunction with fin-spines, which are striated, recurved, serrated on the posterior margin, and evidently the defensive armature of the same fish.

Ptychognáthus (Gr. *ptychè*, a ridge, and *gnathos*, jaw).—Literally "ridge-jaw;" a sub-genus of dicynodont reptiles from the supposed Triassic sandstones of Rhenosterberg, South Africa; and so termed from the prominently-ridged sockets of the canine tusks so peculiar to the *Dicynodont* family, which see.

Ptychólepis (Gr. *ptychè*, a fold or wrinkle, and *lepis*, a scale).—Literally "wrinkle-scale;" a genus of Sauroid fishes, of which several species occur in the Lias of England.

Pudding-stone.—Now used as synonymous with *conglomerate*, but originally applied to a mass of flint pebbles, cemented by a siliceous paste, from the resemblance of the imbedded pebbles to the fruit in a plum-pudding. The *plum-pudding-stone* of Hertfordshire, so often sliced and polished by lapidaries, is composed of black-flint pebbles imbedded in a light-coloured paste; hence the appropriateness of the name.

Pulley-stones.—A familiar term for the hollow casts or moulds of the

joints and stems of encrinites, as they occur in the cherts and rottenstones of the carboniferous formation. Originally enclosed in the siliceous matrix of chert, the calcareous stems of the crinoids have been subsequently dissolved, thus leaving their "screw-like" or "pulley-like" casts. —See ENCRINITE.

Pulveríse (Lat. *pulvis, pulveris,* dust).—To reduce to dust or powder; to crumble. Soil and rocks crumbled down by aqueous or atmospheric agency are said to be *pulverised.*

Pumice (Ital. *pomice,* akin to *spuma,* froth).—Volcanic froth or scum; a light spongy lava, so porous, vesicular, and fibrous, as to float on water. It is usually of a whitish-grey colour, with a sub-pearly lustre, and consists of about 75 silica and 17 alumina, with varying per-centages of soda, potash, and water.

Purbeck Beds.—The uppermost members of the Oolite proper, or, according to others, the basis of the Wealden formation. They derive their name from the island or peninsula of Purbeck, on the coast of Dorsetshire, where they are typically displayed; and consist of argillaceous and calcareous shales, and fresh-water limestones and marbles. They are noted for their layers of fossil vegetable earth (dirt-beds), enclosing roots, trunks, and branches of cycoids and conifers.

Pustulopóra (Lat.) — Literally "pustule-pore;" a common tubular-branched coral of the Chalk formation. The tubes are cylindrical; their apertures are arranged in spiral rows, and slightly projecting, thus giving a pustulous appearance to the stem and branches.

Puy (Fr.)—A provincial term for the conical hill-tops of Auvergne, in Central France, which are for the most part the craters of extinct volcanoes, as Puy de Dome, Puy de Come, &c.

Pýcnodonts, Pycnodontidæ (Gr. *pyknos,* thick, and *odous, odontis,* tooth). — Literally "thick-tooth;" an extensive family of fishes, occurring in mesozoic strata. Their leading character consists in having the mouth provided with a dense pavement of thick, round, and flat teeth, for the purpose of crushing the shells and crustacea on which they fed.

Pygocéphalus (Gr. *pygos,* thick, solid, and *kephalē,* head).—A minute stalk-eyed crustacean from the Coal-measures of Lancashire, described by Mr Huxley in vol. xiii. of *Geolog. Journal.*

Pygópterus (Gr. *pygē,* the rump, and *pteron,* a fin).—Literally "rump-finned;" a genus of sauroid fishes (the *Palæothrissum* of Blainville) characterised by the great development of their sub-dorsal and caudal fins, and occurring throughout the carboniferous and permian formations.

Pyrítes (Gr. *pyr,* fire, and *ites* for *lithos*).—Sulphurets of iron, copper, cobalt, &c., are so termed, either from the hardness of iron-pyrites, which strikes fire, or from its decomposing spontaneously with a considerable evolution of heat. While we thus have "iron-pyrites," "copper-pyrites," "cobalt-pyrites," &c., the term *pyrite* is restricted by mineralogists to the sulphuret of iron, which occurs in rocks of all formations, and seems to be produced either by igneous action, or more commonly from aqueous solution, especially under the influence of decomposing organic matter. It is very liable to decomposition—the sulphur sometimes separating and passing off as sulphuretted hydrogen, and the iron being changed into the hydrated peroxide; at other times it is converted into the sulphate of iron.

Pyrógenous (Gr. *pyr,* fire, and *ginomai,* I am formed).—Fire-formed; produced by fire; used as synonymous with *igneous.*

Pyrolusite.—The mineralogical term for the common binoxide or black-oxide of manganese, in allusion to the facility with which it is resolved by heat into oxygen and a sub-oxide—giving off at a red heat from 10 to 12 per cent of oxygen. It occurs in various states—massive, disseminated, fibrous, earthy, or compact; is of an iron-black or steel-grey colour; semi-metallic lustre; streak black and soiling; specific gravity from 4.7 to 5; hardness from 2 to 2.5, and consists of 63.6 manganese, and 36.4 oxygen, with traces of baryta, silica, and water. "Pyrolusite was formerly confounded with *Manganite* (the Grey oxide), but differs in crystallisation, and in containing no water. It is best distinguished by the colour of the streak, and its softness—often so great as to soil the fingers. It occurs chiefly in beds in gneiss, clay-slate, porphyry, and the older rocks, or in veins often with calc-spar, heavy-spar, and ores of iron and manganese. It sometimes has been produced by the decomposition of the latter; and crystals of manganite are found only partially converted into pyrolusite." As an ore, pyrolusite is worked in many places, and is employed in the manufacture of glass, in glass-painting and enamel, and in the glazing and colouring of pottery.

Pyrophýsalite (Gr. *pyr*, fire, and *physalite*).—Coarse columnar topaz; same as PHYSALITE, which see.

Pýroxene (Gr. *pyr*, fire, and *xenos*, strange).—A name used by Continental mineralogists for *augite*, which see.

Pyxidículum (Lat. a small box).—A genus of Diatoms, whose minute siliceous shields present the appearance of a saucer-shaped box; whence the name. Abound in existing waters, and in recent and tertiary marls or microphytal earths.

Q

Quadersándstein (Ger.)—Literally square-stone or freestone; the German term for certain soft sandstones of the Chalk formation—the *lower quadersandstein* being apparently the equivalent of our upper Greensand, and the *upper* being nearly in the same horizon as our upper white chalk. —See tabulations, "Geological Scheme."

Quadr—, Quadri—, Quadru— (Lat. *quatuor*, four).—A frequent prefix in scientific compounds signifying *four*, or *in fours;* as *quadrangle*, a figure having four angles, and consequently four sides; *quadrilateral*, four-sided; *quadruped*, an animal having four feet—four-footed; *quadri-corns*, furnished with four horns or antennæ; *quadri-partite*, divided into four parts, or arranged in fours, &c.

Quadrúmana (Lat. *quatuor*, four, and *manus*, hand).—Literally "four-handed;" a term applied to the monkeys and lemurs as forming an order distinct from the *bimana* or two-handed mankind. Though termed "four-handed," and furnished with a more or less opposible thumb to each extremity, these animals walk on all-fours—man with his perfectly opposible thumb being in reality the only "handed" animal in creation. Quadru-

manous remains have been found in the lowest eocene tertiaries, if not in the upper chalk formation.

Quagmire or **Quake-mire.**—Boggy or miry ground so saturated with water that the surface quakes or shakes to a considerable extent under the feet of the passer over. The growing surface of these *quaking-bogs* has often considerable tenacity, but once broken, there is nothing beneath save soft "mire" or mud, and that frequently to great and dangerous depths.

Quaquavérsal (Lat. *quaqua*, on every side, and *versus*, turned).—Dipping on every side; applied to strata that dip on all sides from a common centre; dome-shaped or encircling stratification.

Quartz (Ger. *quarz*).—A German miner's term for crystallised silica; rock-crystal; silica is its purest rock-form. As a mineral, quartz is properly colourless, but more frequently coloured in various shades of white, grey, yellow, brown, red, blue, and even black; hence numerous varieties are distinguished by their colours—as *rock-crystal*, the highly transparent varieties; *amethyst*, the violet blue; *topaz*, the wine yellow; *cairngorm*, brown or cinnamon yellow; milk-quartz, rose-quartz, and so forth. *Common quartz*, occurring massive and in veins of various shades of white, is a well-known rock, and according to its colour and lustre is spoken of as *milk-quartz*, *glassy-quartz*, and the like; or mixed with other mineral matter it passes into *jasper*, *Lydianstone*, *hornstone*, *chert*, *flint*, *chalcedony*, *agate*, and numerous other rocks and minerals, in all of which silica constitutes more than nine-tenths of the mass.

Quártzite.—An aggregation of quartz grains; granular quartz. The term is generally applied to sandstones which have been indurated or altered by heat so as to assume the aspect of quartz-rock.

Quartz-rock.—A term usually, and properly, applied to a stratified rock of the metamorphic series, consisting almost entirely of silica, having a granular-crystalline texture, and of a greyish or pinkish-grey colour from the presence of a slight trace of iron.

Quatérnary (Lat. *quatuor*, four).—Applied to all accumulations above the true tertiaries; equivalent to POST-TERTIARY, which see.

Quicklime.—The well-known form of lime after any ordinary limestone (or carbonate of lime) has been exposed to a red-heat in a kiln, so as to expel its carbonic acid. It is a protoxide of calcium, and on being sprinkled with water falls readily to powder, with a crackling noise and great evolution of heat. It has obtained its name from its caustic and corroding qualities.

Quicksilver.—The familiar term for fluid mercury, in allusion to its bright metallic lustre and silver-white colour. It occurs native in rocks of all ages, chiefly with cinnabar (sulphuret of mercury) in veins and fissures; is fluid at ordinary temperatures, but congeals at —40° Fahr., and forms tesseral crystals.—See MERCURY.

Quíncunx (Lat. *quinque*, five).—Strictly speaking, that arrangement of five objects in which they are made to occupy the four corners and the point of intersection of the diagonals of a square. The term, however, is generally applied to any number of objects so disposed in lines that the members of each succeeding line shall stand immediately behind the interspaces or openings in the preceding one. The leaf-scars of *lepidodendron* and the *coniferæ*, and the punctures of *stigmaria*, are arranged in this **quincuncial** order.

R

Radiária.—A term applied by Lamarck to such of the *Radiata* of Cuvier as have *a radiated form of the entire body*. They are the rayed-animals proper, and include only the sea-urchins, star-fishes, and medusæ or sea-nettles.

Radiáta (Lat. *radius*, a ray).—Radiated; arranged round a central axis like the rays or spokes of a wheel. In Zoology, Cuvier's fourth and lowest division of the animal kingdom, including all those animals whose parts are disposed round a central axis in a radiated form, like that of the star-fish. The division embraces *Echinodermata* (star-fish, sea-urchins &c.); *Intestina* (intestinal worms); *Acalepha* (medusæ or jelly-fish); *Polypi* (sea-anemones, coral-polypes, &c.); and the INFUSORIA. Since Cuvier's time this arrangement has been somewhat modified; and the lower groups of animals which are "globular" rather than "rayed" have been erected into an independent class under the title PROTOZOA, which includes such orders as the Rhizopods, Sponges, and Infusoria.—See tabulations, "Animal Scheme."

Radiáted (Lat. *radiatus*).—Adorned with rays; diverging from a common centre like the spokes of a wheel, a form frequent among minerals, as zeolite and radiated iron-pyrites; belonging to the division Radiata or Rayed animals.

Radiolítes.—A genus of Cretaceous bivalves belonging to the curious *Hippurite* family, and so called from the radiated structure of the outer layer of their opercular-looking upper valves. The Radiolite has an inversely conical under-valve, with a deep straight cavity, rough and foliaceous in its outer layers, and smooth within, with a finely-striated margin. It is fitted with a convex or sub-conical opercular-looking upper valve, which gives to the entire shell a somewhat spherical shape, hence the occasional synonym of *Sphaerulite.*—See HIPPURITE.

Rag, Ragstone.—A provincial English term for any hard coarse-textured rock, as "Kentish rag," a tough siliceo-calcareous member of the Lower Greensand, used for building purposes in Kent; "Rowley rag," a hard crystalline greenstone, constituting Rowley Hill, near Dudley, &c.

Rain.—As a geological agent, rain is of prime importance—vitally as well as mechanically; its mechanical effects, however, being the most conspicuous, and that more especially in hilly regions. Every shower that falls exerts a degrading or wasting influence on rocks, soils, and all exposed surfaces. By entering the pores of rocks and soils, rain softens and loosens their cohesion, and thus renders them more easily acted on by currents of wind and water. Land-floods or freshets also arise from rains, the melting of snow, and from hail-storms; and the periodical rains of the tropics produce inundations and similar phenomena. The fall of rain varies in different countries, and of course will be attended with proportional results. In the British Islands it ranges from 24 to 60 inches, or has an average of about 36 inches; while in tropical countries the mean annual fall is upwards of 200 inches—229 inches having been noted

in Dutch Guiana, 276 in Brazil, 302 at an elevation of 4200 feet in the Western Ghauts, south of Bombay; and in the Khasia Mountains, at the head of the river-flats or Jheels of Bengal, upwards of 600 inches, or 50 feet, have been registered by various observers. At the same place, Dr Hooker has recorded 30 inches in twenty-four hours; 21 inches have been noted at Cayenne during the same period; and 23 inches are not uncommon near Port Jackson in New South Wales. Accustomed to the gentle rains of our own island, we can scarcely form an estimate of the changes produced by such sudden and enormous falls on the surface-soil and river-courses of tropical countries.

Rain-Prints.—Every one must have observed the effects of a passing shower on the surfaces of the half-consolidated muds and sands of our tidal shores and estuaries. How it pits and patters them according to the size of the drops, the force with which they are borne by the wind, and the slanting direction in which they impinge! Precisely similar appearances are presented on the stratified surfaces of every formation, from the lowest Silurian up to the latest Post-tertiary — these surfaces having, when soft, received the shower-fall, been subsequently sun-baked and hardened, and then overlaid by new deposits which filled up the pits and patters as so many moulds. These fossil pittings are more or less circular, according to the vertical or slanting direction of the rain-fall; are often large, as from a heavy shower; not unfrequently large and small curiously commingled; and occasionally the same surface bears traces of showers that must have fallen when it was soft and easily impressed, and of others that fell subsequently and made a fainter impression on its partially-baked crust. We have thus not only evidence of the intensity and continuance of these primeval showers, but of the quarter from whence the wind blew that drove them against the muddy flats of long-since obliterated shores and estuaries.

Rake Vein.—In mining, a rent or fissure generally vertical or highly inclined, and cutting indifferently through all the strata. Rake veins are either simple fissures unaccompanied by any displacement of the strata, and known as "gash veins;" or accompanying a fault or dislocation, and then termed "slip veins."

Raptóres (Lat. *raptor*, a seizer or snatcher).—Birds of Prey; an order of birds, so called from their habit of seizing and retaining their prey with their powerful talons. They are partly *diurnal*, as the vultures, eagles, falcons, &c., and partly *nocturnal*, as the owls. Remains of *Raptorial* birds occur in the tertiary strata of Europe—*e.g.*, *Lithornis vulturinus*, &c.

Rasóres (Lat.)—Literally Scratchers or Scrapers; an order of birds, so called from their habit of scraping or scratching up the soil with their feet in order to obtain their food—*e.g.*, the common barn-fowl, turkey, partridge, and the like. Remains of *Rasorial* birds have been found in the bone-caves of England and Germany.

Rastrítes (Lat. *raster*, a rake).—That division of Graptolites (Silurian sea-pens) having the cells placed at wide intervals along the stem or axis, and accordingly standing out bold and pointed like the teeth of a rake.—See GRAPTOLITES.

Rauchwacke (Ger. *rauch*, smoke, and *wackè*).—The German term for one of the upper members of the Permian *zechstein* or magnesian limestone, in allusion to its dark-grey colour. The *Rauchwackè* seems to be the

equivalent of the upper brecciated limestones of Durham and Yorkshire.

Ravíne (Lat. *ravio*, I sound hoarsely).—A deep precipitous gorge; usually the narrow excavated channel of some mountain stream; and so called from the hollow murmur of its waters.

Reálgar.—Known also as *red orpiment* and *red sulphuret of arsenic;* the proto-sulphuret of arsenic (69 arsenic and 31 sulphur), occurring *native* in various formations, either in the form of fine red prismatic crystals, or massive and disseminated. It is also prepared *artificially* from the sesquisulphuret or *yellow orpiment*, which see.

Recent (Lat. *recens*, fresh, still growing).—In Geological classification the term *Recent* is applied to all accumulations and deposits which have taken place during the human epoch, or are still in progress of formation. All accumulations and deposits whose remains belong exclusively to species still existing, are, geologically speaking, "recent," though chronologically of vast antiquity. By most geologists the Recent or Current epoch is regarded as commencing at the close of the Glacial or Boulder-drift period, as manifested in the Northern Hemisphere.

Reddle.—A provincial term for a red argillaceous ore of iron; also called *red-clay* and *red-chalk*. It is simply decomposed hæmatite, having a compact earthy texture; dry, meagre feel; and strong clayey odour when breathed on.

Red Marl.—A familiar designation for the upper members of the New Red Sandstone or Trias, as developed in England. Known also as "variegated marls;" the "Keuper" of the Germans; and the "Marnes irisées" of the French.—See TRIASSIC SYSTEM.

Reef (Sax.)—A riff or ridge; usually applied to a range or ledge of rocks occurring in the sea, and only partially covered, or placed at no great depth under the surface of the water; as the "coral-reefs" of the Southern Ocean.

Regnosaúrus.—Literally "royal-saurian;" a provisional appellation applied by Dr Mantell to the imperfect remains (portion of a jaw and teeth) of a large saurian occurring in the Wealden strata of Tilgate Forest, and probably allied to *Megalosaurus* or *Iguanodon*.

Régur.—The native name for the cotton soil of India, which is said to cover nearly a third part of the southern peninsula, and to range northward to a great distance, and also into the Birman Empire. It occupies nearly level plains; is of a bluish-black or greenish-grey colour—from three to twenty feet in thickness; is of marvellous fertility; and consists of 48.20 silica, 20.30 alumina, 16.00 carb. of lime, 10.20 carb. of magnesia, about 5 of organic matter, and a little oxide of iron. Like the *Tchornozem* of Russia, it is evidently of alluvial origin.

Relíquiæ (Lat.)—Remnants; what is left behind. Usually applied to the remains of living creatures; but in Geology extended to all *organic remains*, whether vegetable or animal.

Reptília (Lat. *repo*, I creep).—In Zoological arrangements the third great division of vertebrate animals, embracing the Batrachians or frogs, the Ophidians or serpents, the Saurians or lizards, the Loricata or crocodiles, and the Chelonians or tortoises. As a class the Reptiles are cold-blooded; some have the body naked, others have it covered with scales, with plates or scutes, or enclosed in a horny shell; they are oviparous, but never hatch their eggs; and are partly terrestrial, partly aquatic, and

partly amphibious. In one or other of the above orders they are found fossil, from the Devonian formation upwards—culminating as it were both in magnitude and in specific variety during the oolitic epoch, which is sometimes styled "the age of Reptiles," or "reign of Reptiles."—See tabulations, "Animal Scheme."

Réniform (Lat. *ren*, kidney).—Kidney-shaped; applied to concretions of ironstone, limestone, &c., which assume a flattish-oblong or kidney-shaped form.

Resin (Lat. *resina*).—A well-known substance which exudes from many trees, and in particular from the firs and pines. It is usually of a yellowish or amber-brown colour, more or less transparent; becomes hard and brittle on exposure to the atmosphere; has a disagreeable taste and aromatic odour; is electric when rubbed; and has a specific gravity (1.0 to 1.3) little exceeding that of water. When heated it readily melts, and if the heat be much increased it takes fire and burns (like other hydro-carbons) with a whitish flame and much smoke. It is soluble in alcohol, ether, and the volatile oils, but is insoluble in water; and in this respect may be distinguished as well as separated from *gum*. It has been defined as "volatile oil rendered concrete by the oxygen of the atmosphere;" and as most plants contain some kind of volatile oil or other, the number of resins is very great. Substances partaking of the nature of gum and of resin (that is, partly soluble in water) are termed *Gum-resins*. Resins, gums, and gum-resins, occur in Tertiary and Post-tertiary formations, and in particular in connection with brown-coal and lignite.

Resin, Mineral.—As a family in mineralogical systems, the *Mineral Resins* include such hydro-carbons as petroleum, bitumen, asphalt, amber, retinite, copaline, hatchetine, and many other pitchy, fatty, or resinous-looking substances, which, with the exception of petroleum, asphalt, and amber, occur in small and unimportant quantities.

Resinous.—Resembling resin; containing or yielding resin; possessing the properties of resin. Hence we speak of certain minerals having a "resinous lustre," of a "resinous odour," and so forth.

Retepóra (Lat. *rete*, a net, and *pora*, a pore).—Literally net-pore; the name given by Lamarck to a genus of fossil Bryozoa or compound molluscs, which, like the existing *flustra*, have their cell-pores arranged in net-like order. They occur in all formations.

Retículated (Lat. *reticulum*, a small net).—Having the appearance of net-work; composed of fibres, and veins or lines which interlace and cross each other like the threads of a net. The veins of an apple-leaf, for example, have this *reticulated* or net-like appearance.

Rétinite or **Résinite.**—Known also as *retinasphalt;* one of the mineral resins occurring in brown-coal and peat-formations, in roundish irregular lumps, of a yellowish-brown colour, resinous lustre, easily broken, and slightly transparent. It is an impure hydro-carbon or fossil resin, usually melts at a low heat, and burns with an aromatic or bituminous odour.

Revérsed (Lat. *re*, back again, and *versus*, turned).—Turned upside down; turned side for side. A *reversed shell*, in Conchology, is one whose whorls run from right to left, or whose aperture is turned to the left hand when the shell is placed before the spectator with its apex upwards.

Rhabdománcy (Gr. *rhabdos*, a rod, and *manteia*, prophecy).—Divination by rod or wand, so as to indicate where metals, minerals, and water may be obtained from the crust of the earth—a superstitious practice not

altogether abandoned in some parts of Britain, and still to some extent followed in the south of France and Italy, under the names of *Metallascopy* and *Hydroscopy.* "The divining-rod," says Brande, "is a branch of a tree, generally hazel, forked at the end, and held in a particular way, by the ends, in the hand of the adept; and is supposed to indicate the position of the substance sought by bending towards it with a slow rotatory motion—the adept, according to modern practice, being placed in contact with some metallic or other magnetic substance."

Rhinóceros (Gr. *rhis, rhinos,* the nose, and *keras,* horn).—Literally "snout-horned;" a well-known pachyderm of Asia and Africa, deriving its name from the solid, fibrous horns (one or two in number according to species) which arm its snout. The living rhinoceroses are strictly inhabitants of the hotter parts of the Old World—the one-horned of Asia, and the two-horned and others of Africa; and all are heavy, bulky animals delighting in marshy river-grounds, and feeding on leaves, soft roots, and succulent branches. Several fossil species occur in the later tertiaries of Europe—in lake-silts, bone-caves, and breccias; and more remarkable still, carcasses of one of these species (*R. tichorinus*) have been found in fair preservation in the frozen soil of Siberia. Though thus discovered ranging over the whole of Europe and Northern Asia, we have no authentic instance of a fossil rhinoceros occurring either in America or Australia—a distribution that finds its parallel in the case of many other tertiary animals.

Rhizópoda, Rhízopods (Gr. *rhiza,* a root, and *pous, podos,* foot).—The lowest class of the Protozoa of modern zoologists. They are minute, cellular animals (either simple or aggregated), and are so called from their motions being performed by processes or *root-like* extensions of the substance of which they are composed. They are interesting to the geologist, from the fact that the so-called *Foraminifera* which compose a large bulk of the Chalk, &c., are compound Rhizopods enclosed in a chambered shell-like case—each cell-body occupying its own chamber.—See POLYTHALAMIA and FORAMINIFERA.

Rhódium (Gr. *rhodon,* a rose).—A rare metal discovered by Wollaston in 1803, and usually associated with *osmium, iridium,* and *palladium* (other rare metals) in the ores of Platinum. It derives its name from the red colour of one of its solutions, though its own colour is white or silver-grey. It is extremely hard, and used as nibs for gold pens.

Rhodócrinus (Gr. *rhodon,* a rose).—Literally "rose-encrinite;" a genus of palæozoic encrinites in which the column is cyclindrical and traversed by a pentagonal canal; the rays or arms arise by a single ossicle, and then bifurcate; the receptacle is formed of three, five, ten, or more numerous series of plates, which are ornamented externally by fine radiating ridges.

Rhódonite (Gr. *rhodon,* a rose).—A silicate of the protoxide of manganese; known also as manganese spar; and so named from its dark rose-red colour. It occurs in various formations and variously associated, and consists of 48 silica, 49 protoxide of manganese, with a little lime and iron.

Rhomb (Gr. *rhombos*).—In Mathematics and Crystallography, a four-sided figure whose sides are equal, but whose angles are not right angles; a compressed square, if one might so speak. **Rhomboid,** rhomb-like, lozenge-shaped; a four-sided figure having its opposite sides equal, but all its sides are not equal, nor are its angles right angles. **Rhombohedron,** a solid figure contained within six equal rhombs.

Rhomb-Spar.—A variety of dolomite or crystallised magnesian limestone, already described under the name of BITTER-SPAR, which see.

Rhopálodon (Gr. *rhopalon,* a club, and *odous, odontos,* tooth).—Literally "club-tooth;" the generic name applied by M. Fischer to certain reptilian remains from the Permian deposits of Russia. These remains consist of detached teeth and fragments of jaws with teeth, of thecodont reptiles, apparently related to the saurians from the Permian conglomerates of Bristol.—See THECODONTOSAURUS.

Rhynchonélla (Gr. *rhynchos,* a beak).—Literally "little-beak;" a genus of brachiopodous bivalves, forming the type of the family *Rhynchonellidæ,* and so termed from their acutely-beaked umbones. In rhynchonella the shell is somewhat trigonal, acutely beaked, usually plaited; dorsal valve elevated in front, depressed at the sides; ventral valve flattened, or hollowed along the centre; hinge-plates supporting two slender curved lamellæ. Only two or three living species are known from the deeper waters of arctic and antarctic seas; but upwards of two hundred fossil species have been catalogued, from the lower Silurian upwards.

Rhynchosáurus (Gr. *rhynchos,* a beak, and *sauros,* lizard).—Literally, "beak-saurian;" a remarkable genus of saurians from the New Red Sandstone of Warwickshire, combining the lizard type of skull with toothless jaws. "The general aspect of the cranium," says T. R. Jones, "resembles that of a bird or turtle, the intermaxillary bones being very long, and curving downwards, thus imparting to the fore part of the head the profile of a parrot. There are no teeth apparent in either jaw, and Professor Owen supposes that this reptile may have had its jaws encased by a bony or horny sheath as in turtles. Footmarks of a small reptile, with the print of the hind-toe pointed backwards, occur on the surface of some of the Warwickshire sandstones, and are, with much probability, conjectured to have been impressed by the Rhynchosaurus."

Rhyncolítes or **Rhyncholítes** (Gr. *rhynchos,* a beak, and *lithos,* stone).—The fossil beak-like mandibles of cephalopods (like the cuttle-fish and nautilus) which generally occur detached in the lias, oolite, and chalk formations.

Rhytidólepis (Gr. *rhytis, rhytidos,* a wrinkle, and *lepis,* scale).—The term applied by Sternberg, Cotta, and others, to the *Sigillaria,* in allusion to its thick, corrugated outer-back.—See SIGILLARIA.

Ripple-mark.—This term is applied by geologists to the ridgy or wavy surface of many sandstones, from its resemblance to the *ripple* produced on a sandy sea-shore by the receding tide. As this ripple is produced by the passage of any gentle current over a movable surface, we have *wind-ripples, tide-ripples, current-ripples,* and the like; and it requires discrimination on the part of the observer to determine the nature of the producing cause in the ancient formations.

River (Lat. *rivus;* Gr. *'reo,* I flow).—Geologically, streams and rivers act chiefly in a mechanical way, and their influence depends partly on the nature of the rocks over which they run, the rapidity of their flow, and their size or volume of water. If the rocks over which they pass be of a soft or friable nature, they soon cut out channels, and transport the eroded material in a state of mud, sand, and gravel to the lower level of some lake, to their estuaries, or to the bed of the ocean. Their cutting as well as transporting power is greatly aided by the rapidity of their currents; hence the power of mountain torrents compared with the quiet and sluggish flow of

the lowland river. It has been calculated, for example, that a velocity of three inches per second will tear up fine clay, that six inches will lift fine sand; eight inches, sand as coarse as linseed; and twelve inches, fine gravel; while it requires a velocity of twenty-four inches per second to roll along rounded pebbles an inch in diameter, and thirty-six inches per second to sweep angular stones of the size of a hen's egg. During periodical rains and land-floods the currents of rivers often greatly exceed this velocity; hence the tearing up of old deposits of gravel, the sweeping away of bridges, and the transport of blocks many tons in weight—an operation greatly facilitated by the fact that stones of ordinary specific gravity (from 2.5 to 2.8) lose more than a third of their weight by being immersed in water. Nor is it the mere velocity of rivers which produces their eroding or cutting power, but the amount and nature of the debris carried down by their torrents—every pebble and block of shingle rubbing and striking and grinding still deeper and deeper the channels down which they are borne. The geological effects of rivers on the crust is thus of a twofold nature—viz., to waste and wear down the higher lands, and then to bear along the waste material and deposit it in valleys, in lakes, or in the ocean, in the state of mud, clay, sand, or gravel.

River Basin.—In Geography, the whole extent of valley-shaped or basin-shaped country drained by any river and its tributaries—*e.g.*, the "Basin of the Tay," the "Basin of the Severn."

Rock.—The "crust," or external portion of the earth accessible to human research, is composed of substances less or more solid, and all known to the geologist by the name of *Rocks*—these rocks the products, in the main, of aqueous and igneous agencies. No matter whether in the state of soft and yielding clay, of incoherent sand and gravel, of dull earthy chalk or sparkling marble, of friable sandstone or the hardest granite—all are spoken of as "rocks" and "rock-formations." In this sense the term *rock* is purely technical; and it has even been proposed by German mineralogists to extend the term to ice and water as being principal constituents of the earth's mass.

Rock-Basins.—Curious basin-shaped cavities occurring in the granites of high and exposed regions like that of Dartmoor in Devonshire, and varying from one to many feet in diameter, and from a few inches to several feet in depth, with edges more or less sloping, and generally containing pebbles or other gravelly detritus whose motion, with the aid of water, seems to have been the efficient cause of their formation. At one time superstition ascribed the excavation of these "basins" or "pot-holes" to the Druids; but no one now for a moment doubts, that however these early priests may have used them, they are the direct results of decomposition and attrition on the softer portions of the felspathic granite.—See vol. xv. of *Geol. Journal* for some interesting details of the Dartmoor basins, by Mr Ormerod.

Rock-Butter.—A soft, yellowish admixture of alum, alumina, and oxide of iron, oozing out of rocks which contain alum. A product of decomposition.

Rock-Cork.—A variety of asbestus whose fine fibres are so interlaced and matted as to give it the texture and lightness of cork. Occurs in veins and crevices in serpentine and similar rocks, and often known as "mountain-cork."—See ASBESTUS.

Rock-Crystal.—A familiar term for the transparent and colourless varieties of crystallised QUARTZ, which see. Though usually colourless and

transparent, "rock-crystal" occurs in various shades, and the term is even extended to smoke-coloured and perfectly black varieties. It is customary, however, to distinguish the coloured varieties by separate names; hence the purple are known as *amethysts;* the yellow, *topazes;* the amber-coloured, *cairngorms,* and so on. Rock-crystal is found in veins, fissures, and other cavities in every geological formation, but chiefly and most perfectly in the older crystalline and granitic rocks. The primary form is rhombohedral, but it usually occurs either in six-sided prisms, acutely terminated by six planes; in acute simple six-sided pyramids; or in such prisms and pyramids doubly terminated. The largest and finest specimens are obtained from the Alps, Pyrenees, Siberia, Brazil, Ceylon, Madagascar, and in a less degree from Saxony, Norway, and the Scottish Highlands. The purest sorts consist almost entirely of silex, with a trace of alumina, lime, oxide of iron, or other colouring matter; have a fine vitreous lustre, a specific gravity of from 2.5 to 2.8, and a hardness of 7., being in this respect only inferior to corundum and diamond.

Rocking-Stones.—Weather-worn rounded blocks, generally of granite or tabular greenstone, so nicely poised on their basis that a very ordinary force suffices to make them oscillate or "rock" from side to side.—See LOGAN or LOGGING-STONES.

Rock-Salt.—The familiar as well as scientific term for common salt (chloride of sodium), when it occurs in the earth's crust as a solid rock-mass. In the British Isles the great repository of rock-salt is the Trias or Upper New Red Sandstone; but deposits of equal magnitude are found in connection with oolitic strata, as in the Salzburg Alps, with cretaceous greensands as at Cordova in Spain, with chalk and tertiary rocks in the valley of Cardona in the district of the Pyrenees, with tertiary marls as in Sicily and at Wielitska in Poland; and salt springs are known to issue from carboniferous and older strata. It is thus a product of all epochs, and must have been formed either by the gradual and long-continued desiccation of limited areas of salt-water alternately cut off and placed in connection with the ocean, or by precipitation from saturated solutions, perhaps brought about by the evaporating power of volcanic or other thermal agency. The Cheshire deposits of rock-salt, which may be taken as a typical illustration, lie along the line of the valley of the Weaver, in small patches, about Northwich. There are two beds lying beneath 120 feet of coloured marls, in which no traces of animal or vegetable fossils occur. The upper bed of salt is 75 feet thick: it is separated from the lower one by 30 feet of coloured marls, similar to the general cover; and the lower bed of salt is above 100 feet thick, but has nowhere been perforated. They extend into an irregular oval area, about a mile and a half in length, by three quarters of a mile in breadth. The salt in these deposits is sometimes pure and transparent, and at other times is of a dirty reddish hue, and mixed to the amount of half its bulk with earthy impurities. It is not stratified or laminated, but divided into vertical prisms of various forms and magnitudes, sometimes more than a yard in diameter—the outer sides of these rude crystallisations being generally pure and transparent.

Rock-Soap.—Known also as *mountain-soap;* one of the Clays or silicates of alumina, of a pitch-black or bluish-black colour, very greasy feel, writes but does not soil, adheres strongly to the tongue, and falls to pieces in water. Occurs in veins and fissures. The compacter sorts are cut into crayons; the softer are used as a fulling material.

Rock-Wood.—A variety of asbestus, of a brown colour, and occurring in long compacted fibres which give it the aspect and texture of wood; hence the name.—See ASBESTUS.

Rodéntia (Lat. *rodo*, I gnaw).—Literally rodents or "gnawers;" an extensive class of mammals, so called from their habit of gnawing or nibbling their food, which generally consists of the harder and drier vegetable substances, and for which purpose they are provided with sharp chisel-shaped incisors—*e.g.*, the rat, hare, beaver, squirrel, and porcupine.

Roe-Stone.—A familiar English term for *Oolite*, from its being composed of an aggregation of small rounded grains or spherules, which, taken in the mass, present considerable resemblance to the roes of fishes.—See OOLITE.

Roof.—In coal-mining, the stratum or material immediately overlying the workable coal, from its forming, as it were, a roof or covering to the operations of the miner. In metalliferous veins, the overhanging part or wall of the vein.

Rosalína (Lat. *rosa*, a rose).—A genus of many-celled foraminiferous organisms, so called from the circular or rose-like disposition of the chambers. In Rosalina the cells are arranged round a central spire in one or more whorls, the outer chambers gradually becoming larger and more inflated. The opening is on the under or depressed side, and the whole external surface is minutely punctured.

Rostellária (Lat. *rostellum*, a little beak).—One of the Strombidæ or Wing-shells, of which five or six species inhabit the Indian and Chinese seas at moderate depths, and of which upwards of seventy species occur fossil, from the Lower Greensand inclusive. Shell with an elongated spire; whorls numerous and flat; canals long; outer lip more or less expanded, with a single sinus close to the beak. The older tertiary species have the outer lip enormously expanded and smooth-edged; those with keeled and spiniferous whorls form the sub-genus *Spinigera*.

Rotália, Rotalítes (Lat. *rota*, a wheel).—A genus of foraminiferous shells, so called from their nautiloid wheel-like contour. They are extremely minute, and appear in the Lias, Oolite, and Chalk in immense numbers and many species, and still swarm in the present seas. Though nautiloid in their aspect, they are regularly turbinated, the cells decreasing in size towards the apex or centre.

Roth-todte-liegende.—Literally "red-dead-liers;" the name given by German miners to the red sandstones and marls which lie under the *Kupfer-schiefer* or copper-slate, because they are "dead" or non-metalliferous. They seem to be the equivalents of the lowermost Permian sandstones of the North of England.

Rotífera (Lat. *rota*, a wheel, and *fero*, I bear).—An order of Infusorial animalcules, so called from the revolving wheel-like motion of the rows of vibratile cilia (hair-like processes) which surround their mouths, and by which they move through the water, as well as create currents to bring within their reach the organised atoms on which they feed. They are divided into *Nuda* and *Loricata*—the former having the body soft and naked, the latter covered with a sheath.

Rotten-Stone.—A siliceo-aluminous compound, resulting from the decomposition of impure limestone by the percolation of carbonated waters. Most of the rotten-stone of commerce (used for polishing metals, &c.) is derived, like that of Derbyshire, from the decomposition of siliceous lime-

stones—the lime being decomposed, and the silex remaining as a light earthy mass.

Rowley-Rag.—The hard, fine-grained crystalline greenstone constituting Rowley Hill in the Dudley coal-field. "This trap-rock," says Mr T. R. Jones, "supplied the materials for the important experiments by Gregory, Watt, and Sir James Hall on the fusion and cooling of rocks; and has of late been employed by Messrs Chance, at Oldbury, near Birmingham, in the manufacture of molten indestructible architectural materials."

Rubble.—A quarryman's term for the loose covering of angular fragments which appear at the outcrop of many sandstones. Applied also to all accumulations of loose angular fragments not water-worn and rounded like gravel and shingle.

Rubellite (Lat. *rubeo*, to flush with red).—A mineralogical term for the fine red varieties of TOURMALINE, which see.

Rubicelle.—A lapidary's term for the fine yellow or orange-red varieties of the spinel RUBY, which see.

Ruby (Lat. *rubeo*, I flush with red).—A mineralogical and lapidary's term for the fine red transparent varieties of *Spinel* and *Corundum*, which see. The finest red and violet varieties are obtained from Ceylon, Ava, and other parts of the East, hence known as the *Oriental ruby*, and which, when uniform in colour, free from flaws, and large, ranks next to the diamond among gems. It is customary to distinguish the rose-red varieties as *Balas-ruby;* the yellow or orange-red as *Rubicelle;* and the violet as *Almandine-ruby:* but of course there are many intermediate shades, as there are diversities of composition, among the so-called "rubies" of the lapidary and jeweller. The "corundums" proper consist almost entirely of alumina, with a minute proportion of iron peroxide or other colouring matter; the "spinels," on the other hand, contain from 10 to 20 per cent of magnesia, with minute but varying proportions of silica, lime, and chrome. Both corundum and spinel are found *in situ* in gneiss and granitic rocks; but the chief supply of the "rubies" of commerce is obtained from the gravelly detritus of streams and mountain torrents.

Rugose (Lat. *ruga*, a wrinkle).—Full of wrinkles; having a coarse irregular surface like the bark of an old oak or elm; covered with many wrinkles or minute folds, like the shell of the *Buccinum undatum* or common whelk.

Ruminántia (Lat. *ruminare*, to chew the cud).—An important group of quadrupeds, often referred to in Zoology and Palæontology, and including those which, like the ox, deer, goat, sheep, &c., *ruminate*, or chew the cud. They are all vegetable feeders, have cloven hoofs, and are void of canine and incisive teeth in the upper jaw.

Rust (Sax.)—The powdery oxide or tarnish which covers the surfaces of metals exposed to the action of a moist atmosphere; hence we have the well-known "iron rust," "copper rust," and so on.

Rútile, Rútilite (Lat. *rutilus*, red).—Native oxide of titanium coloured by the peroxide of iron, and so called from its deep and often dark-red colours. It usually occurs in long prismatic or acicular crystals, and is common in granite, gneiss, and mica-schist, often investing and penetrating rock-crystal in these formations. It is used in porcelain-painting to produce a yellow colour.

Ryácolite (Gr. *ryax*, *ryakos*, a stream, and *lithos*, stone).—A species of felspar, whitish, transparent, and of vitreous lustre; so called from its

being found with augite, nepheline, and mica in the lava-streams of Vesuvius. Many of the so-called "glassy felspars" belong to this species, which consists of 50 silica, 30 alumina, 10.56 soda, and 6 potash, with traces of lime and magnesia.

S

Saarbruck, in Lorraine, whose coal formation abounds in beautiful specimens of *Palæoniscus*, *Amblypterus*, and other allied fishes. These organisms occur in the slaty shales and in the ironstone nodules.

Sáccharite (Lat. *saccharum*, sugar).—A species of felspar occurring in fine granular masses, of a vitreous lustre, and white or greenish-white colour; whence the name. It is found in veins in serpentine, in the chrysoprase mines, near Frankenstein in Silesia.

Sáccharoid (Gr. *sacchar*, sugar, and *eidos*, likeness).—Resembling loaf-sugar in texture; applied to crystalline limestones like the fine statuary marble of Carrara.

Sacrum, Sacral.—In Anatomy, the posterior bone of the pelvis, articulated to the last lumbar vertebra, and firmly united on each side to the hip-bones, forming, as it were, the "key-stone" of the pelvic arch. In young animals the *sacral vertebræ* (which are of variable number in different groups) are generally distinct and separable, but become united or anchylosed (less or more) into one piece, according to age and specialities of structure.

Saddle-Back.—A familiar term for anticlinal strata, from their sloping or dipping right and left in saddle form.—See ANTICLINE.

Safety Lamp.—A lamp invented by Sir Humphry Davy to prevent the explosion of fire-damp in coal-mines, familiarly termed by the colliers a "Davy." It consists of a lamp completely surrounded by *wire-gauze*, having a mesh from $\frac{1}{40}$ to $\frac{1}{60}$ of an inch in width, and through which the explosive mixture cannot, under ordinary circumstances, be fired. There are various modifications of this invention by Stephenson, Clanny, Mueseler, and others; but in all, the essential principle is the non-transmission of flame through tubes or openings, whose diameters do not exceed the fortieth part of an inch—the wire-gauze acting merely by its cooling power. See DAVY LAMP.

Sáhlite.—A variety of augite, so called from its being discovered in the silver mines of Sahla in Sweden. It occurs in columnar, lamellar, or granular concretions, usually of a light or greyish-green colour, of a shining pearly lustre, and, for the most part, imbedded, as in iron and lead ores, and in altered limestones.—See AUGITE.

St Cuthbert's Beads.—A North of England term for the detached bead-like joints of the encrinite, from a legend alluded to by Sir Walter Scott in *Marmion*,—

"On a rock by Lindisfarne,
St Cuthbert sits and toils to frame
The sea-born beads that bear his name."

Salamandróides (literally, salamander-like).—The term originally applied by Dr Jäger to certain salamander-like remains from the Upper New Red Sandstone of Wirtemberg; but since critically examined by Professor Owen, and classed with LABYRINTHODON, which see.

Sal-Ammóniac.—Muriate or hydrochlorate of ammonia; so called from the Temple of Ammon in Egypt, where it was originally obtained by burning camel's dung. It is now largely procured by other processes, and occurs *native* in crusts, stalactites, and pulverulent masses, chiefly in the rents and fissures near active volcanoes. It is of a greyish or yellowish white, according to impurities of iron, sulphur, &c.; has a saline pungent taste; is easily soluble in water; and volatilises without fusing. Used in medicine, dyeing, and various metallurgic operations.

Salámstein, Salámstone.—A familiar term for the fine blue transparent varieties of Oriental *Sapphire,* which see.

Salíferous (Lat. *sal,* salt, and *fero,* I yield).—Containing or yielding salt, as "saliferous strata," "saliferous deposits," &c. *Saliferous System* was at one time used by English geologists as synonymous with Upper New Red Sandstone, which is the great repository of rock-salt and brine springs in England; but as other formations in different countries are equally rich in this mineral, the designation has been all but abandoned for that of *Trias* or *Triassic.*—See ROCK-SALT.

Salifíable (Lat. *sal,* salt, and *fio,* I become).—Having the property of becoming *a salt;* capable of being converted into the form of a salt by combination with an acid; hence the "salifiable bases" of the chemist.

Salíne (Lat. *sal,* salt).—Containing or impregnated with salt; as "saline springs," "saline incrustations," &c.

Sal-mirábile (Lat.)—Literally, "wonderful salt;" a term of the older chemists for sulphate of soda or *Glauber's Salt,* which see.

Salses.—Eruptions of hot acidulated mud from small orifices, generally in volcanic districts, and often accompanied by steam and gases at a high temperature, which act powerfully on the surrounding solid matters, disintegrating and decomposing them, and forming new compounds. In some districts the gases are inflammable, and flames issue from the orifices.

Salt (Gr. *hals,* Lat. *sal*).—This term, though in ordinary language limited to common salt or sea-salt, is in Chemistry and Mineralogy applied to all combinations of acids with alkaline or salifiable bases; hence we have such terms as *haloid salts, copper salts, lead salts,* and the like. "The nomenclature of salts," says Brande, "has reference to the acids which they contain; *sulphates, nitrates, carbonates,* &c., implying salts of the sulphuric, nitric, and carbonic acids. The termination *ate* implies the maximum of oxygen in the acids, and *ite* the minimum; thus the salts of sulphurous and nitrous acids are called *sulphites* and *nitrites.* When salts contain one equivalent of acid and one of base, they are called *neutral salts;* where one equivalent of acid is combined with two of base, they are termed *basic salts, subsalts* or *disalts;* and where there are two equivalents of acid and one of base, the salt is a *supersalt* or *bisalt.* Thus the terms *subacetate of lead* and *diacetate of lead* are synonymous; so are *supercarbonate* and *bicarbonate of potash.* Many salts are *hydrous*—that is, they contain a definite proportion of water of crystallisation; others are destitute of water, and are dry or *anhydrous* salts. Some attract moisture when exposed to the air, and are said to be *deliquescent;* others suffer their water to escape and become opaque or pulverulent, and are said to be

efflorescent."—**Common Salt,** which is a chloride of sodium, is obtained either by the evaporation of sea-water and brine-springs, or by the treatment and purification of rock-salt. It is indispensable as a condiment or article of food, and is largely employed in glass-making, enamelling, glazing, bleaching, and other industrial processes.

Saltpétre (Lat. *sal,* salt, and *petra,* stone).—The familiar term for nitrate of potash, or *Nitre* (which see), from its being found native generally in loose stony soils.

Sánadine.—An occasional synonym for glassy felspar, a variety of *Orthoclase,* or potash-felspar, which see.

Sand (Sax.)—Any aggregation of water-worn particles, derived from pre-existing rocks and other mineral substances. Sand is generally composed of quartz-grains (quartz being one of the hardest of simple minerals, and longest resisting the processes of attrition); but it may also consist of the particles of shells, corals, &c.; hence such terms as "shell-sand," "coral-sand," and the like.

Sandstone is simply consolidated sand—the particles (whether siliceous or calcareous) having been compacted by pressure, or being held together by lime, clay, oxide of iron, or some other cementing material. Some sandstones, like those of Edinburgh and St Andrews, contain upwards of 98 per cent of pure silica, the remainder being lime, alumina, and iron.

Saponáceous (Lat. *sapo,* soap).—Feeling like soap to the touch; having a soapy feel, as steatite, and many other allied minerals. Also capable of being worked into a lather like soap, as the juice or mucilage of many plants, aquatic and terrestrial.

Sápphire (Gr.)—A highly transparent variety of corundum, with a very imperfect cleavage and conchoidal fracture—those of fine red colours being often named "Oriental rubies," and those of blue "Salamstein." It consists of alumina, with a trace of peroxide of iron and other colouring matter. The "sapphire blue" of the Greeks and Romans seems to have been the *lapis-lazuli,* and not this gem.

Sárcolite (Gr. *sarx,* flesh, and *lithos,* stone).—An unimportant variety of *Analcime* (one of the Zeolites); and so called from its fine flesh-colour.

Sardónyx.—A variety of onyx (which see); and said by some to derive its name from *Sardes* in Lydia, and by others from *Sardo,* the Greek name for Sardinia—both being localities from which it was obtained for cameo manufacture.

Sássoline (from *Sasso,* near Sienna).—The mineralogical term for *boracic acid,* which occurs in thin, scaly, irregular six-sided crystals, of a whitish colour, pearly lustre, and less or more translucent. The crystals have an acidulous and slightly bitter taste, feel greasy, and are easily soluble in boiling water. Boracic acid (or "hydrous boracic acid," as it is often termed) occurs, with various impurities, in many volcanic regions; in the hot springs of Sasso, near Sienna; and in the *lagoni* of Tuscany, where many thousand pounds are annually obtained by evaporating the water.

Satin Spar.—A familiar term for the finely-fibrous, silky varieties of *Arragonite,* or prismatic calc-spar, many of which are susceptible of a fine polish, and exhibit the lustre of satin; whence the name.

Saturated (Lat. *saturus,* full).—Full to overflowing; water saturated with salt is water that can dissolve no more of that substance—every additional particle that is added to this "saturated solution" falling to the bottom undissolved.

Sáurian (Gr. *sauros*, a lizard).—Of or pertaining to the *Saurians*, or scaly reptiles, of which the common lizard has been taken as the representative. As a section, the Saurians comprehend the lizards, monitors, iguanas, chameleons, &c., all well-known forms among living species; and the ichthyosaurus, plesiosaurus, deinosaurus, iguanodon, and numerous other extinct and gigantic forms, some of which were marine, others terrestrial—some carnivorous, and others herbivorous. As an order, the Saurians are characterised by their elongate rounded bodies, densely covered with imbricated or granular scales; by their elongate, tapering, usually scaly tails; limbs four, but occasionally rudimentary, and completely concealed under the skin; ribs distinct and movable; sternum distinct; mouth not dilatable, jaws toothed; eyes and ear-cavities prominent and exposed; eggs with a hard skin or crust; and young not undergoing any metamorphosis.

Saurocéphalus (Gr. *sauros*, lizard, and *kephalè*, head).—Literally "lizard-headed;" a genus of fossil fishes of the Cycloid order of Agassiz, found in the Chalk formation, and so named from the peculiar formation of the head.

Sáurodon (Gr. *sauros*, lizard, and *odous*, tooth). — Literally "lizard-toothed;" a genus of fossil fishes of the Cycloid order, found in the Chalk, and so termed from the sauroid character of their teeth.

Sáuroid (Gr. *sauros*, lizard, and *eidos*, likeness).—Like or akin to the Saurians; a convenient term implying affinity or resemblance without asserting absolute identity.

Sauroídei.—One of Agassiz' orders of fossil fishes; so called from their exhibiting, in their structure and dentition, certain *sauroid* or reptilian characters. They occur in the Carboniferous, Permian, Oolitic, and Chalk systems; and their remains (teeth, bones of the head, &c.) often indicate fishes of great size and pre-eminently predaceous habits; *e.g.*, *megalichthys*, *sauropsis*, *saurichthys*, &c.

Sauroídei-Dipteríni. — One of Agassiz' orders or sub-orders of fishes, mainly characterised by having rows of true *fish-teeth* on the outer edges of the jaws, and irregularly implanted *reptilian-teeth* on the inner plates. The forms are chiefly Devonian, and embrace such genera as *dipterus*, *diplopterus*, *osteolepis*, *glyptolepis*, &c.

Saurópsis (Gr. *sauros*, lizard, and *opsis*, appearance). — A genus of sauroid fishes occurring in the Oolitic system, and so named by Agassiz from certain characteristics of their dentition.

Saussúrite. — An impure variety of *Labradorite*, or Labrador felspar, occurring in compact, sub-translucent masses, of a bluish or greenish grey, in many hypersthene rocks; and so named in honour of the French philosopher Saussure.

Savannahs.—In Physical Geography, the low wooded flats of North America, in contradistinction to the open, treeless, and grassy plains known as *prairies*.

Scáglia (Ital., a scale or chip).—An Italian calcareous rock, the equivalent of our white chalk. In the north of Italy it contains nodules and layers of flint; yields ammonites, belemnites, and the like; is of a red colour, and has a fissile structure; hence the name.

Scaglióla (Ital., diminutive of *scaglia*).—An artificial composition employed in architectural facings and ornamentation; consisting of pure finely-powdered Plaster-of-Paris, or calcined gypsum, Flanders glue, isin-

glass, &c.; and made to resemble the natural *scaglia* limestone. Known also as *Mischia*, from the mixture of colours employed in it, being made to imitate marble.

Scaláriform (Lat. *scalaris*, a ladder, and *forma*, form).—Presenting the appearance of a ladder; applied by botanists and microscopists to certain vessels in the woody structure of the cycads and conifers having an elongated form, and crossed by connecting fibres, like the steps of a ladder.

Scálent (Lat.)—Climbing; the sixth of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain —the "Climbing Day" of the North American palæozoics, and the equivalents in part of our upper Silurians.—See PALÆOZOIC FORMATIONS.

Scáphite (Lat. *scapha*, a skiff).—A genus of the Ammonite family, peculiar to the Chalk formation, and so named from the boat-like contour of its shell—the inner whorls looking like an ancient reversed prow, and the last chamber, which is free, produced horizontally, and then sharply recurved, forming, as it were, the boat and stern.

Scápolite (Gr. *skapos*, a rod, and *lithos*, stone).—A silicate of alumina and lime occurring in long prismatic (rod-like) crystals which lie parallel, diverge, or cross each other, and are either imbedded or in drusy cavities. It is also found massive with a granular or columnar structure; is less or more transparent; has a vitreous or resinous lustre; and is colourless or coloured—pale-grey, greenish-yellow, or red. Its composition is very uncertain. It is found in metalliferous veins, in beds of crystalline limestone, and usually associated with calc-spar, quartz, felspar, and mica. It has been taken as the type of the Scapolite family, which includes several closely-allied minerals—*palagonite*, *nepheline*, *prehnite*, *nephrite*, &c.—See tabulations, "Mineral Scheme."

Scápula, Scápular Bone (Lat.)—The shoulder-blade; a bone which, from its size and position, is frequently found detached in a fossil state. "It is broad and flat, generally triangular, sometimes sub-quadrilateral, in Mammals; narrow and commonly sabre-shaped in Birds; narrow and straight in Saurians; a round, strong, and straight column in Chelonians; and variously shaped and articulated to the back of the skull in most Fishes."

Scar or Scaur (Sax.)—A bluff precipice of rock; hence the term "Scar Limestone," applied to the mountain limestone as it occurs in the hills of Yorkshire and Westmoreland.

Scar-Limestone.—The name given by English geologists to the lower group of the Carboniferous Limestone, as developed in bluff precipices and lofty "scars" in the north-western districts of Yorkshire and in Westmoreland.

Scarped (Fr. *escarper*, to cut steep).—Having a steep face; worn or cut away so as to present a steep precipitous face.

Schiller-Spar (Ger. *schillern*, to change colour).—A massive magnesio-siliceous mineral, of a greyish-green or yellowish-brown colour, having a pearly metallic lustre, flat cleavage, and exhibiting a slight play of colour. Is generally found in connection with serpentine; and is closely related to *Bronzite* and *Diallage*—being softer, and containing more water than the former, and more magnesia and less lime than the latter. Thus an average of analyses gives—

Schiller-spar,	43 silica,	26 magn.,	3 lime,	13 iron prot.,	1 mangan.,	2 alumina,	13 water.
Diallage,	51 ,,	16 ,,	17 ,,	6 ,,	4 ,,	3 ,,	2 ,,
Bronzite,	56 ,,	30 ,,	2 ,,	8 ,,	1 ,,	1 ,,	2 ,,

Schist (Gr. *schisma,* a splitting or division).—This term should be restricted to such rocks as mica-schist, chlorite-schist, gneiss, and the like, which have a foliated structure, and split up in thin irregular plates, not by regular cleavage as in clay-slate, nor in large flat laminæ, as in flagstones. Hence we speak of the "crystalline schists," meaning thereby gneiss, mica-schist, chlorite-schist, and the like, as distinct from the *slates,* which in this sense are retained for the Clay-slate formation. In the *slates* the splitting-up may be said to be perfect and indefinite; the *schists* or *schistoze rocks,* on the other hand, are only capable of an imperfect separation into layers and laminæ.

Schizópteris (Gr. *schiza,* a cleft, and *pteris,* fern).—An obscure genus of coal-measure ferns, so called from their palmated or deeply-cleft leaflets. They have been found surrounding the stems of *sphenopteris,* and from this circumstance are supposed to have been climbers, and indicative of a tropical climate.

Schlérodus (Gr. *schleros,* rough, and *odous,* tooth).—A provisional genus of fishes found in the Ludlow bone-bed (upper Silurian), and so named from the minute pustules on the surface of their teeth. The jaws and teeth are the only portions yet found.

Schorl (Swed. *scorl,* brittle).—Known also as *Black Tourmaline,* a prismatic, longitudinally-striated mineral, of a pitchy lustre and colour, brittle texture, and capable of being rendered electric by heat or friction. It occurs abundantly in the sparry cavities and veins of the Granitic rocks.—See TOURMALINE.

Scolíthus or **Scolítes** (Gr. *skolios,* tortuous).—Applied to those tortuous tube-like markings which occur in certain sandstones, and which seem to have been the burrows of annelids.

Scoriáceous. — Resembling scoriæ; applied to loose, cindery debris, having the aspect or character of scoriæ.—**Scorified,** reduced to scoriæ, or cindery dross.

Scóriæ (Ital. *scoria,* dross).—Applied to all accumulations of dust, ashes, cinders, and loose fragments of rocks, discharged from active volcanoes. Properly speaking, the term refers to the *scum-like dross* which floats on the surface of molten masses, and which, when cooled down, breaks up into loose cindery fragments and clinkers. We may have, thus, the scoriæ of a glass-furnace as well as the scoriæ of a volcano; though the term is generally applied to the cindery products of the latter.

Screw-Stones.—A familiar term for the hollow siliceous casts of encrinite stems, frequently occurring in the cherts and rotten-stones of the Carboniferous limestone; and so called from the resemblance of the numerous interspaces of the jointed columns to the threads of a screw.—See PULLEY-STONES.

Seal.—In Zoology, the familiar term for a well-known genus and family (*Phocidæ*) of marine carnivorous mammals frequenting our own shores, but abounding especially on the sub-arctic coasts of Newfoundland, Labrador, Greenland, and Spitzbergen, where they are hunted for their oil, and killed in incredible numbers. The seal is not known in a fossil state earlier than the close of the Glacial or Upper Pleistocene period.

Seam.—Strictly speaking, the line of separation between two strata, which

often differs in colour from the strata themselves, and looks like the seam between two portions of a garment; but loosely applied to subordinate beds occurring in any series, as *seams of coal* in the Coal-measures, which are in the main composed of sandstones, shales, and clays.

Secondary Strata.—Originally applied to the fossiliferous strata lying between the Transition and Tertiary of Werner; now employed as equivalent to *Mesozoic;* that is, comprehending the Trias, Lias, Oolite, Wealden, and Chalk formations.

Sectile (Lat. *sectilis*).—Capable of being cut; applied in Mineralogy to those rocks and minerals which can be cut with a knife without causing the particles to spitter and fly about. Talc, mica, and steatite yield quietly to the knife, and are thence said to be "sectile."

Section (Lat. *sectus*, cut through).—Literally, a cutting through, as of the trunk of a tree, to display its internal structure. A geological section represents the structure of the earth's crust on any given line in a vertical direction; and is either *natural*, as seen in cliffs and precipices; *artificial*, as in quarries, tunnels, and coal-pits; or *theoretical*, when constructed from a number of observations on the position of the strata in various adjacent localities. As the earth is so vast, compared with any means of representation we have at our command, and as the thickness of the strata is so small, compared with the length of most lines of section, "theoretical sections" are in general mere indications of what they are intended to represent, but indications of vast utility when read with proper understanding.

Sécular (Lat. *sæculum*, an age).—Applied in Geology to great natural processes, whose results become appreciable only after the lapse of ages: thus we speak of the "secular refrigeration" of the globe from some hypothetical state of original igneous fluidity; "of secular contraction" of the earth's mass, as resulting from its gradual refrigeration, and so on.

Sédiment.—(Lat. *sedere*, to settle down).—Matter settled down from suspension in water. If the turbid muddy waters of a river be allowed to stagnate, the mud will gradually fall to the bottom and form *sediment.* Rocks which have been formed in this manner, as shale, clay, sandstone, &c., are termed *sedimentary;* that is, sedimented from mechanical suspension in water. The term, however, is generally applied to all the *stratified* rocks, whether produced exactly in this way, or generally by the operations of water.

Seláchia (Gr. *selas*, a flash of light).—The Cartilaginous order of fishes, as the sharks and rays; said to be so called from their emitting a phosphorescent light.—See tabulations, "Animal Scheme."

Sélenite (Gr. *selenè*, the moon).—Sulphate of lime or gypsum, when it occurs in fine transparent crystals; so termed from its subdued lustre and transparency.—See Gypsum.

Semi— (Lat.)—A frequent prefix in scientific compounds, literally signifying "half," but frequently implying merely defect or incompleteness; as *semi-circle*, half a circle; *semi-transparent*, imperfectly transparent. Same as the Greek *hemi*—which see.

Semionótus (Gr. *semeion*, a mark or device, and *notos*, the back).—Literally "stamped-back;" a genus of Liassic fishes belonging to the *Lepidoid* order; and so called by Agassiz in allusion to the peculiar character of the dorsal scales.

Semi-Opal.—Literally "half-opal;" a term applied to the duller and less pellucid varieties of common *Opal*, which see.

Sepals (Lat. *sepes*, a fence or enclosure).—The leaf-like divisions of the cup or *calyx* which encloses the *corolla* or blossom of a flower. The impressions of *sepals* are not unfrequent in a fossil state; those of the *petals* or divisions of the blossom are exceedingly rare and doubtful.

Sepíadæ (Gr. *sepia*, the cuttle-fish).—A well-known family of cephalopodous molluscs belonging to the Decapod division of the Dibranchiate order, and of which the common cuttle-fish (*Sepia officinalis*) has been taken as the type. The family is characterised by an internal rudimentary shell, in the form of a friable calcareous plate, imbedded in the back part of the mantle, and from which the *pounce* of the chemist is derived. The family includes several fossil forms—*Spirulirostra, Beloptera, Belemnosis*, &c.—See tabulations, "Animal Scheme."

Septárium, plural **Septária** (Lat. *septum*, a fence or division).—Flattened nodules of calcareous clay, ironstone, or other matter, internally divided into numerous angular compartments by reticulating fissures which are usually filled with calcareous spar, and show well against the darker matrix of the nodule. The reticulating fissures or *septa* seem to have arisen from the shrinkage of the mass while in the act of consolidating, and to have been subsequently filled by infiltration. Such argillaceous, calcareous, and ferruginous nodules are common in many clays and marls; are often arranged in lines or bands; are always more or less flattened; generally contain some central organic nucleus round which the matter has aggregated, such as a leaf, scale, coprolite, or the like; and when split up in the direction of the stratification, frequently exhibit very curiously marked sections; hence the names *bettle-stones, turtle-stones, Ludi Helmontii*, and the like.—See Nodular Structure.

Septum, plural **Septa** (Lat.)—A partition or division. The thin plates which separate the chambers of the Nautilus and Ammonite are termed *septa;* so also the thin radiating divisions which give to the pores of corals their star-like or rayed appearance.

Seral (Lat.)—Late, the nightfall; the last or uppermost of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain—the "Nightfall," metaphorically speaking, of the North American palæozoics, and the equivalents of our upper or true Coal-measures.—See Palæozoic Formations.

Series.—Applied to any number of allied objects arranged in sequence. In Geological classification, any set of strata possessing some common mineral or fossil characteristic, as the Greensand series, Wenlock series, &c. A subordinate group in some great formation or system.

Serpentine. — A siliceo-magnesian rock of granitic or metamorphic origin; so called from the resemblance of its variegated colours to the skin of a serpent. Common or compact serpentine occurs in veins, dykes, or imbedded masses; is usually dark-coloured (green, grey, red, or brown), and often spotted, striped, or veined; is rather soft and sectile; has a dull splintery fracture; and feels greasy. Though soft it is susceptible of a fine polish, and being easily cut and turned on the lathe, it is fashioned into various ornamental articles, as that of Lizard Point in Cornwall, and Portsoy in Banffshire. Its average composition seems to be 44 silica, 43 magnesia, and 13 water. Besides the common serpentine, also known as *ophite*, mineralogists distinguish *noble serpentine*, usually of some shade of green, translucent, and having a resinous lustre when polished; *marmolite* or foliated serpentine; *picrolite* or fibrous serpentine; and *chrysolite* or

asbestiform serpentine of a fine oil-green colour and silky lustre, but considered by some as a distinct mineral.

Sérpula, Serpúlidæ.—A family and genus of annelids deriving their name from the tortuous and twisted tubes they inhabit. The animals of this family are fixed or sedentary; and have elaborate calcareous tubes or crusts for their protection. They have feathery or arborescent gills surrounding their heads; hence the occasional term Cephalobranchiate Annelidans. The shelly tubes of the *Serpulæ* occur on every shore, incrusting stones, rocks, shells, drift-wood,. sea-weeds, &c.; and are readily distinguished by their tortuous and irregular forms. In tropical seas some species live in large colonies, their shelly exuviæ forming banks resembling coral-reefs in their solidity and extent.

Serpulítes.—The general palæontological term for all fossil tortuous tubes and tube-like organisms apparently allied to those of the existing Serpulæ; and evidently the products of tube-forming Annelids. They occur in all formations from the Silurian upwards, and in some of their forms have often been mistaken for the shells of Mollusca. Whatever their forms, they are always smooth within, have no chambers or divisions, and exhibit no traces of muscular attachment.

Sertulária (Lat. *sertum*, a wreath).—A genus of hydroid polypes, so called from their cells being arranged on the opposite sides of a fleshy or horny axis, this giving to their stems a wreath-like appearance. The Silurian *graptolites*, though similarly disposed, may have no real affinity either to the *sertulariæ*, *pennatulæ*, or *virgulariæ*, of existing seas.

Séssile (Lat. *sedeo*, I sit).—Applied to animals and organisms that are closely attached to other objects, and not supported on a pedicle, foot-stalk, or stem. Thus the balanus or acorn-shell is *sessile* when compared with the lepas or goose-barnacle, which is supported on a fleshy *pedicle*; and the eyes of some crustaceans are attached to the carapace, while those of others are surmounted on movable foot-stalks. *Sessile* and *pedunculated* are thus opposing terms.

Séta, plural **Sétæ** (Lat., bristle, bristles).—A term frequently and variously applied in Natural History. In Botany, the bristle-like stalk that supports the theca or seed-case of mosses; the awn or beard of grasses; the glandular points of the rose, &c. In Zoology, the stiff short hairs that clothe many caterpillars and insects; the bristles that arm the rings of the earth-worm and form its points of progression; the stiff processes that cover the limbs and mandibles of many crustaceans; and the like.

Setáceous (Lat. *seta*, a bristle).—Covered or armed with bristles; bristle-like; in form and character resembling a bristle; bristly.

Setígerous (Lat. *seta*, bristle, and *gero*, I carry).—Literally "bristle-bearing;" applied to the organs of plants and animals that are covered or armed with short stiff processes resembling bristles.

Shale (Ger. *schalen*, to peel or shell off).—Applied to all argillaceous strata that exhibit a laminated structure, and consequently split up more or less perfectly in the direction of their bedding. *Clay*, for example, is massive or plastic and void of structure; *marl* is friable or crumbly; *shale* always exhibits some degree of lamination and fissility. As regards its composition, there is every variety of shale, and this is usually defined as calcareous, arenaceous, bituminous, and so forth, as the case may be.

Shanklin Sand.—A name occasionally given to the Lower Greensand of

the Chalk formation, from its being conspicuously developed at Shanklin, in the Isle of Wight.

Shell (Sax.)—Familiarly and loosely applied to any hard crust or covering; but in Zoology restricted to the hard calcareous coverings of the Mollusca or Testacea. According to Brande, the mineral or hardening principle of shell is carbonate of lime nearly pure. The animal principle in the porcellaneous shells (*e.g.* the cowries) is a small quantity of soluble gelatine: in the mother-of-pearl or nacreous shells (*e.g.* the pearl-oyster) it is albuminous. The latter, therefore, when steeped in dilute muriatic acid, leave a membranous or cartilaginous residue; but the former are entirely soluble.

Shell-Marl.—Applied to all deposits of *marl*—that is, soft earthy deposits of lime in the bottom of fresh-water lakes and other stagnant waters—in which shells are present in notable proportion. In British shell-marls the most abundant shells are *paludina, lymnea, planorbis,* and *cyclas;* and in less proportion *ancylus, unio,* and the minute cases of entomostracous crustaceans.—See MARL.

Shell-Sand.—On certain coasts the tide- and wave-washed sands are in a great measure composed of the broken and triturated shells of the mollusca common to the locality. To such masses the term *shell-sand* is usually applied; and where readily accessible it forms an available fertiliser.

Shingle.—Loose imperfectly-rounded stones and pebbles, as distinct from gravel and sand. The "shingle beaches" which are piled along certain portions of our coasts, and the "shingle barriers" which occur at the mouths of many rivers, are merely masses of rock debris in the process of attrition to gravel and sand.

Síenite, Sienític, more frequently and properly SYENITE, which see.

Sigillária (Lat. *sigillum*, a seal).—An extensive genus of Coal-measure stems, characterised by their furrowed or channeled surfaces, and named in allusion to the leaf-scars, which look like so many seal impressions on the ridges or raised flutings. In *Sigillaria* the scars of the leaves are small, round, and much narrower than the ridges of the stem; while in *Favularia*, which has also a furrowed stem, the scars are square, and as broad as the ridges. Sigillaria occurs in great profusion and many specific forms (upwards of fifty species have been named), and of all sizes, from stems the girth of the arm to trunks several feet in diameter, and upwards of sixty feet in length. From the flattened state of many of the trunks, it appears to have been a tree of little substance, and yet many of its characters forbid the supposition of its being hollow, like the reed or cane. In many instances it is found growing *in situ*, and in whole forests; and in such instances it is always furnished with the dichotomising or forking roots, known as *stigmaria*. Regarding the affinities of *sigillaria*, some would refer it to the tree-ferns, others to the palms, and some again to the coniferæ; but the truth is, that while it exhibits characters touching on several existing orders, there is in reality no living family wherewith to compare it. According to M. Brongniart, who has made it the subject of a special memoir (*Archives du Muséum d'Histoire Naturelle*, 1839), "Sigillaria constituted a peculiar extinct family, belonging to the great division of gymnospermous dicotyledons. They were tall erect trees, with a regular and cylindrical stem, without side-branches, but dichotomous towards the summit. Their superficial bark was hard and durable,

channeled longitudinally, bearing leaf-scars that are of a rounded form above and below, and angular at the sides, often oblong in relation to the stem, and having three vascular pits, one central and small, and two lateral of a large size. The internal structure bears most analogy to that of the Cycadeæ, and the foliage consisted of long, linear, carinated leaves. The Sigillariæ, therefore, differ essentially from the arborescent cryptogams, which they somewhat approach in having scalariform vascular tissue, symmetrical and regular leaf-scars, and branchless trunks."

Silex, Sílica (Lat. Gr. *chalis,* a pebble).—In chemical language, "the earth of flints." This important substance (we abridge and modify from Brande) constitutes the characteristic ingredient of a great variety of siliceous minerals; among which rock-crystal, quartz, chalcedony, and flint, may be considered as silex nearly pure. It also predominates in many of the rocky masses which constitute the crust of our globe, such as granite, quartz rock, and the numerous varieties of sandstone. Although silica has none of the ordinary or more obvious acid properties, yet as it combines in definite proportion with many salifiable bases, and expels carbonic acid when fused with the carbonated alkalies, it is very commonly termed *Silicic acid,* and its various compounds have been denominated *Silicates.* When pure and colourless rock-crystal is heated red hot, and quenched in water, it becomes opaque and friable; and if in this state it be reduced to powder, it presents one form of pure silica. If in this state (in which it is perfectly insoluble in water) it be fused with three parts of carbonate of potash, it forms a glass which is soluble in water, and from this solution (formerly called *liquor of flints*) the concentrated acids throw down the silica in the form of a *gelatinous hydrate;* but if the solution be diluted, and the acid gradually added, the alkali may be perfectly neutralised without any deposition of silica, which, therefore, is thus exhibited in a very soluble state: when, however, the solution is evaporated to dryness, the silica remains in a state as insoluble as before. This solubility of hydrated silica, whilst when dry it is perfectly insoluble, may serve to explain the occasional occurrence of silica in mineral waters, and its deposition in various chalcedonic incrustations. But silica presents another very remarkable character; which is, if we reverse the above proportions, and fuse together a mixture of one part of carbonate of potash and three of powdered rock-crystal or calcined flint, we then obtain a transparent and fusible compound which is insoluble in water, and which in fact is *glass.*—See Glass.

Silíceous (Lat. *silex,* flint).—All rocks having a flinty texture, or into whose composition *silica* enters as a notable ingredient, are said to be siliceous. Rock-crystal and quartz are the purest states in which *silex* occurs in nature; common flint is an impure variety; and chert and hornstone are still more impure admixtures.

Siliceous-sinter (*see* Sinter).—A siliceous incrustation or deposit from springs holding silica in solution, like the Geysers of Iceland. It has often a mammillary surface, and exhibits internally numerous successive lines or layers of deposit.

Silicífied (Lat. *silex,* flint, and *fio,* I am made).—Converted into flinty or siliceous matter; petrified by the infiltration of silica in a state of solution, as the silicified stems from Antigua, the desert of Cairo, and Van-Diemen's Land.—**Silicification** is a common process in the neighbourhood of hot springs, which generally hold a notable proportion of silica in solution

—*e.g.* the Geysers of Iceland, and the hot springs of the Azores and of Tongariro in New Zealand.

Silt.—This term is properly applied to the fine impalpable mud which collects in lakes and æstuaries, but is generally used to designate all calm and gradual deposits of mud, clay, or sand; hence we speak of "marine silt," "tidal silt," and of harbours being partially filled or *silted up* with tidal debris.

Silurian System.—The name originally given by Sir Roderick Murchison (and now adopted by all geologists) to that vast suite of fossiliferous strata which lies between the Non-fossiliferous Slaty-schists beneath and the Old Red Sandstone above, from the fact of their being well developed, and first worked out by him, in the district between England and Wales anciently inhabited by the *Silures* under their chief *Caractacus* or Caradoc. In the typical region of Shropshire, &c., the system consists of the following members:—

UPPER SILURIAN.

Ludlow Series,	Finely laminated reddish and greenish sandstones, locally known as "Tilestones." (In part, base of Devonian System). Micaceous grey sandstone in beds of varying thickness. Argillaceous limestone (Aymestry limestone). Shale with concretions of limestone (Lower Ludlow).
Wenlock Series,	Concretionary limestone (Wenlock limestone). Argillaceous shale in thick beds (Wenlock shale). Shelly limestone and sandstone (Woolhope and Mayhill). Gritty sandstones and shales (Upper Llandovery).

LOWER SILURIAN.

Llandeilo Series,	Grits and sandy shales (Lower Llandovery). Thick-bedded whitish freestone (Caradoc sandstone). Dark calcareous flags and slates (Bala beds). Slaty flags and bands of limestone (Llandeilo and Lingula flags). Gritty flags and slates (Longmynd or "Bottom Rocks").

In other regions the nature of the rocks may differ from the above; but in all—whether Scotland, Scandinavia, Bohemia, Russia, or North America —the same facies of Life prevails, and the Silurian as a SYSTEM is distinctively characterised by its *graptolites;* its corals, *heliolites, favosites,* &c.; its echinoderms, *actiniocrinites, cystideæ,* &c.; its brachiopods, *lingulæ, terebratulæ,* and *orthidæ;* its chambered shells, *lituites* and *Maclurea;* its *serpulites* and *cornulites;* its crustacea, *calymene, asaphus, trinucleus,* and other trilobites, most of which are never found beyond the limits of Silurian strata. Its fauna is eminently marine, and exhibits most of the great forms of invertebrate life; but as yet few *fishes* have been detected, and these chiefly in the uppermost beds of the system. Its flora is still imperfectly known — scattered and fragmentary sea-weeds, indistinct stems of aquatic plants, and a few pinnules and spore-cases of lycopodaceous, and twigs of lepidodendroid land-plants, being all that has yet been discovered in strata unmistakably Silurian.

Silver. — An early and well-known metal of a peculiar white colour (silver-white), brilliant lustre, malleable, ductile, and soft when pure. Its specific gravity is from 10.5 to 11; it melts at about 1000° Fahr.; it is not altered by air or moisture, but is readily tarnished or blackened by sul-

phuretted hydrogen. It occurs *native* in the older rocks, in threads and strings, in arborescent, moss-like aggregates, and in plates and nuggets often of considerable magnitude. In its native state it often occurs as an *alloy* with gold, platina, copper, or arsenic—more frequently perhaps with platina than with any other metal. It is also largely obtained from *ores*, generally as a *sulphuret*, and often in intimate union with ores of lead, antimony, bismuth, &c.—so that the ores yielding silver are, strictly speaking, ores of other metals. These ores are found chiefly in the primary and transition strata; though argentiferous lead ores occur abundantly in secondary strata.

Sinter (Ger. *sintern*, to drop).—Compact incrustations from siliceous or calcareous springs are known as *siliceous-sinter* and *calc-sinter*. The term is used in contradistinction to tuff or tufa, which is open and porous, and wants the hard ringing sound of sinter when struck by the hammer.

Síphuncle (dim. of *siphon*, a tube).—Any small tube or tubular passage; usually applied to the tube-like perforation which passes through the septa and chambers of such shells as the nautilus, ammonite, and ceratite.

Siválic or **Sewalick Hills.**—A range of minor mountains skirting the southern base of the Himalayas, and celebrated in geology chiefly through the discoveries of Dr Falconer and Colonel Sir Proby Cautley. "It has proved," says the former, "more abundant in genera and species than any other region yet explored. As a general expression of the leading features, it may be stated that it appears to have been composed of representative forms of all ages, from the oldest of the tertiary period down to the modern, and of all the geographical divisions of the Old Continent grouped together into one comprehensive Fauna in India."

Sivathérium (*Siva*, an Indian goddess, and *therion*, beast).—The generic term applied by Dr Falconer to the skull and bones of a gigantic mammal found in the Sivalic tertiaries, and forming, as it were, a link between the ruminants and large pachyderms. "It was larger than a rhinoceros, had four horns, and was furnished with a proboscis; thus combining the horns of a ruminant with the characters of a pachyderm. When living it must have resembled an immense antelope or gnu, with a short and thick head, and an elevated cranium crested with two pairs of horns—the front pair being small and the hinder large, and set quite behind, as in the Aurochs. With the face and figure of the rhinoceros, it had small lateral eyes, great lips, and a nasal proboscis."—See *Fauna Antiqua Sivalensis*, by Falconer and Cautley.

Skórodite (Gr. *skorodon*, garlic).—A hydrous arseniate of iron, of a leek-green colour, inclining to brown; and supposed to be a secondary production from the decomposition of ores containing arsenic and iron. It fuses before the blowpipe, giving out a strong smell of garlic; whence the name.

Slate (Sax.)—Any thin plate of rock; any rock that can be split (*schlittsen*) into thin laminæ or plates, like roofing-slate. This term is now generally, and should be, restricted to argillaceous rocks, like common roofing-slate, whose lamination is not produced by bedding, but is due to a metamorphism called *cleavage*, which often traverses the rock at right angles to the lines of stratification. Foliated rocks, like gneiss and mica-schist, are termed *schists*, not slates; and thinly-bedded sandstones are *flagstones* and *tilestones*.—See CLAY-SLATE and CLEAVAGE.

Slate-spar.—A variety of calcareous spar; so called from its occurring in thin slaty lamellæ, often with a shining white pearly lustre, and greasy feel.—See CALC-SPAR.

Slaty.—Resembling slate; having the cleavable or fissile structure of clay-slate. Somewhat loosely applied to all hard thinly-laminated rocks; as "slate-clay" or slaty clay, a hard fissile shale; "slate-coal" or slaty coal, a hard laminated variety of bituminous coal.

Slide.—A miner's term for a minor slip or dislocation of the strata, the fissure being usually filled with fine unctuous clay, which makes the one side appear to slip or *slide* away from the other.

Slikensides.—In Mining, the smooth striated surface of a fault or fissure apparently produced by convulsive friction, and subsequently coated with a siliceous or calcareous glaze by the passage of water or heated vapours. Also provincially applied to an ore of galena occurring in Derbyshire.

Slip.—A familiar term for a fault or dislocation, as if the one portion of strata had *slipped* or slid away from the other.—See FAULT.

Smerdis (Gr.)—A genus of ctenoid fishes often occurring in shoals in the tertiary marls of Aix in Provence. They are of small size—rarely exceeding three or four inches in length—and the species are generally characterised by their dorsal fins and widely-forked tails.

Soapstone.—A soft sectile variety of steatite; so called from its soapy or saponaceous feel when rubbed between the fingers—a characteristic possessed by most magnesian minerals.—See STEATITE.

Soda.—The oxide or rather protoxide of sodium; one of the alkalies, obtained from the ashes of marine plants, and largely and inexhaustibly from sea-salt. Several of its compounds are well-known constituents of the earth's crust; as the muriate (*common* or *rock-salt*); the carbonate (*natron*); the nitrate (*nitratine*); the sulphate (*Glauber's salt*); the borate (*borax*), &c. Its compounds also occur as notable ingredients in many rocks and minerals; *e.g.* the felspars and zeolites.

Sodium.—The metallic basis of soda, discovered by Davy in 1809. Sodium has a bright lustre, and a white silvery colour, with a tinge of red. It is soft and readily moulded at 60°, melts at 194°, and rises in vapour at a red heat. It is lighter than water, its specific gravity being only 0.972. It is rapidly oxidised on exposure to the air, and on being thrown into water floats about upon the surface and quickly disappears—being converted into soda, which is dissolved in the water. Its affinity for oxygen prevents its occurrence in nature as *sodium;* but the compounds of *soda* are sufficiently abundant—forming rock-masses in the solid crust, occurring in the ocean and other saline waters, entering into the composition of many rocks and minerals, being present in all marine and many land plants, and appearing likewise in the structure of the higher animals, which all instinctively swallow large quantities of its chloride.—See SODA.

Soil (Lat. *solum*).—The usual term for that superficial earthy covering of our planet, in which plants grow and flourish, and which we cultivate, for their artificial growth, in our fields and gardens. It is an intimate admixture of disintegrated rock-matter (clay, sand, &c.) with decomposed vegetable and animal substances; and is readily distinguishable by its dark loamy colour from the inorganic "subsoil" of clay, sand, or gravel that lies beneath. Agriculturists distinguish soils partly by their prevailing constituents, as *loamy, sandy, clayey,* &c.; and partly by their fitness for the growth of certain crops, as *turnip soils, clover soils,* and the like.

Solenhofen, near Aichstadt in Germany, a locality celebrated for its fine lithographic slate, which has yielded to the palæontologist many of the rarest and most perfect specimens of reptiles and mammals peculiar to the upper Oolites.

Solenítes (Gr. *solen,* a tube or pipe).—A genus of oolite stems or leaves, so called from their fistular or tubular nature. They occur in matted masses, are narrow, regularly striated, taper-pointed, and not unlike, in general aspect, the leaves of the common quill-wort, *isoëtes lacustris.*

Solfatára (Ital. *solfo,* sulphur).—A volcanic fissure or other orifice from which sulphureous vapours, hot mud, and steam are emitted. Akin to the *fumaroles, hornitos,* and *salses* that occur in most volcanic areas.—See VOLCANOES.

Spar (Ger. *spath*).—A mineralogical term applied to those crystals or minerals which break up into rhombs, cubes, plates, prisms, &c., with smooth cleavage faces. Hence we have calc-spar, felspar, brown-spar, Iceland-spar, and the like. The term is often used as synonymous with crystal, as "*sparry-cavities,*" "*sparry-fissures,*" &c., meaning thereby that the cavities and fissures are studded with crystals.

Spatángidæ.—A tribe of fossil echinites or sea-urchins peculiar to the Chalk and Greensand, and distinguished by the following characters:—Case oblong or heart-shaped; mouth elongated traversely and destitute of proper jaws, situated in front of the centre of the base and near the anterior border of the periphery; ventral outlet towards the posterior margin; tubercles and spines all very small. The tribe has been subdivided into *spatangus* proper (in which the ambulacra are petaloid, the external row of pores slightly elongated, and the inner rows round), *ananchytes, micraster,* and *holaster,* which see.

Spathic (Lat. *spatha,* a blade).—Applied in Mineralogy to minerals having an even-lamellar or flatly-foliated structure.

Spáthose (Gr. *spathè,* a flower-sheath).—Occurring in broad plates or lamellæ, foliated in texture, as some varieties of gypsum, and other calcareous minerals.

Specular (Lat. *speculum,* a mirror).—Having a smooth brilliant surface that reflects light more or less perfectly; hence "specular iron ore," and the like.

Speeton Clay.—A deposit frequently alluded to by English geologists. It occurs at Speeton, near Scarborough in Yorkshire, and appears by its fossils to represent the Lower Greensand of the south of England, but is exceptional in its appearance, as it consists of a dark-blue laminated bed, with nodules of clay ironstone.

Sphæréda (Gr. *sphaira,* a sphere or globe).—The name given to certain vegetable organisms from the Oolite, consisting of a striated stem, bearing numerous branchlets, each of which is terminated by a globular berry-like body—hence the name.

Sphaérodus (Gr. *sphaira,* a sphere, and *odous,* tooth).—Literally "globe-tooth;" a genus of oolitic fishes belonging to the *Pycnodont* family, and so called from the globular shape of their teeth.

Sphæroid or **Spheroid** (Gr. *sphaira,* a sphere).—A figure having a shape nearly resembling that of a perfect sphere or globe. The earth being flattened at either pole to the extent of some thirteen miles, is not a perfect *sphere,* but an oblate *spheroid.*—**Spheroidal,** having the outline or figure of a spheroid; globular.

Sphærosíderite (Gr. *sphaira*, a globe, and *sideros*, iron).—A mineralogical term applied to the botryoidal or reniform concretions of *siderite*, or sparry carbonate of iron, in allusion to their rounded forms. The "Kidney iron ore" of the miner.—See SIDERITE.

Sphærulítes (Gr. *sphaira*, sphere, and *lithos*, stone).—A genus of thick sub-conical chalk shells, externally striated, and furnished with a concentrically arranged opercular-looking upper valve. They belong to the *Hippurite* family, from which genus they differ in having only one internal longitudinal ridge, and in having the external surface roughened by irregularly raised sheathing-plates of successive growths.—Same as RADIOLITES, which see.

Sphenacánthus (Gr. *sphen*, a wedge, and *acantha*, a thorn or spine).—A provisional genus of ichthyodorulites or fin-spine belonging to some unknown cestraciont of the lower coal-measure period. Occur abundantly in Scotland.

Sphenophýllum (Gr. *sphen*, *sphenos*, a wedge, and *phyllon*, leaf).—The *Rotularia* of Sternberg; a genus of coal-measure plants having verticillate (or whorled) wedge-shaped leaves—the leaves dilating at the apex, and being furnished with dichotomous veins. From these characteristics, Dr Lindley "has scarcely any doubt that *Sphenophyllum* was one of those plants which in the ancient world represented the Pine tribe of modern Floras." M. Brongniart, on the other hand, regards them as herbaceous plants related to the Marsiliaceæ or Pepper-worts.

Sphenópteris (Gr. *sphen*, a wedge, and *pteris*, fern).—A genus of fossil ferns, so named from the prevailing form of the leaflets; occurring profusely in the Carboniferous system, less abundantly in the New Red Sandstone and Oolite, and dying out in the Greensand. The genus is characterised by its twice or thrice pinnated leaves; leaflets contracted at the base, not adherent to the rachis, lobed; lower lobes largest, diverging and somewhat palmate; veins one or more strongly marked in each leaflet.

Spículum, plural **Spicula** (Lat.)—Literally, a point or sting; in Zoology the term is usually applied to those minute needle-shaped siliceous or calcareous particles which are imbedded in the fibrous mass of sponges, recent and fossil.

Spider.—Remains of the spider order (*Arachnida*) have been found in the lower Oolites; and circumstances render it probable that they existed as early as the Carboniferous era.

Spiniferítes (Lat *spina*, a spine, and *fero*, I bear).—A term employed by Dr Mantell to designate those minute spherical bodies beset with spines, which occur in the chalk and flint, and which were at one time regarded as identical with the microscopic *xanthidia* of Ehrenberg. "The real nature of these fossils," says the author of the term, "must be regarded as still undetermined. Their prevalence in the chalk-flints, whose forms are derived from zoophytes, seems to countenance the supposition that the Spiniferites are the gemmules or early state of animals of this family; but I have never detected any organic connection between them and the Porifera with which they are associated."

Spírifer (Lat. *spira*, a spire or coil, and *fero*, I bear).—A genus of brachiopods whose broad-hinged deeply-striated bivalves occur abundantly in Silurian, Devonian, and Carboniferous strata. The Spirifers occur in many specific forms, and are so termed from the spiral calcareous processes which in the living state supported the ciliated *brachia* or arms. These

processes being internal, are only observable by carefully laying open finely-preserved specimens.

Spirolína, Spirolinite (Lat. *spira*, a coil or spire).—A genus of minute many-chambered foraminiferous organisms occurring in the chalk; and so termed from the spiral or whorl-like termination of their crosier-like forms.

Splint or **Splent Coal**.—A Scotch term for a hard laminated variety of bituminous coal, intermediate in texture between cannel and common pit-coal. The name is derived from its splitting (or *splenting*) up in large flaggy or board-like laminæ.

Spongítes.—This term, says Mantell, is applied generically to those fossils which appear to be identical in structure with the ordinary marine sponges that consist of a fibro-reticulated porous mass, destitute of regular tubes or canals: the form exceedingly various.

Spore, Spórule (Gr. *spora*, seed).—The reproductive germ of cryptogamic plants, as the ferns and clubmosses. Such spora are often found attached to their fronds, as in the Devonian *Cyclopteris Hibernica;* or in drifted masses, as in the Coal-measures; and even (according to Dr Hooker) as early as the Ludlow rocks of the Upper Silurian era.

Squaloid (*squalus*, shark, and *eidos*, like).—Shark-like; resembling, appertaining to, or having something in common with, the shark family.

Squamose (Lat. *squama*, a scale).—Scaly; covered with scales; having a scale-like aspect, structure, or arrangement.

Staaren-stein (Ger.)—Literally "star-stone;" the popular German designation of *Psarolites* or silicified fern-stems, in allusion to the star-like markings produced by sections of the vessels that compose their tissues.—See PSAROLITES.

Staláctite (Gr. *stalasso*, I drop).—Applied to those icicle-like incrustations of lime, chalcedony, &c., which often fret the roofs of caverns and fissures, and which arise from the dropping of water holding these rock-matters in solution.

Stalágmite (Gr. *stalagma*, a drop).—The same mineral matter as *stalactite*, but applied to the incrustation that covers the floor of the cavern. The stalactites and stalagmites frequently meet each other, and form pillarlike masses in limestone caverns; and occasionally a linear fissure in the roof, by the direction it gives to the dropping of the lapidifying water, forms a perfectly transparent curtain or partition of purest alabaster.

Stanníferous (Lat. *stannum*, tin).—Yielding or containing tin; applied to veins, rocks, and superficial deposits containing the ores of tin; hence we have "stanniferous gravels," as well as "stanniferous vein-stones."

Stéatite (Gr. *stear*, fat).—A soft magnesian or talcose mineral having a smooth, soapy, or greasy feel; hence the name. It is a mere massive talc or talc-stone, occurring in subordinate beds in serpentine and chlorite-schist; usually of a greyish or yellowish-green colour; having a fibro-laminated texture; soft and easily sectile. *Soapstone, potstone*, and other talcose rocks (silicates of magnesia), are mere varieties.

Stégodon (Gr. *stegè*, roof, and *odous*, tooth).—One of the sub-genera into which Dr Falconer divides the Elephants, fossil and existing. The term has reference to the gable-end form presented by a section of their molars taken longitudinally through the ridges of the crowns. "The Stegodons" (Dr Falconer in *Geological Journal*, vol. xiii.) "constitute the intermediate group of the Proboscidea, from which the other species diverge, through

their dental characters, on the one side into the Mastodons, and on the other into the typical Elephants."

Stellated (Lat. *stella*, a star).—Star-like; having the fibres, crystals, or other members, diverging in all directions from a common centre.

Steneosaúrus (Gr. *stenos*, narrow, and *sauros*, lizard).—A genus of Crocodilians found in the Chalk and Greensand, and characterised by their long, narrow, beak-like muzzles; whence the name. They are closely allied to *Teleosaurus*, but differ in the nasal orifices (which are situated at the extreme tip of the muzzle) being semi-circular instead of widely-circular.

Steppes.—A Tartar term, adopted by Geographers for those extensive flats or plains which occupy so large a portion of Northern Asia and Siberia. They are generally covered with long rough grass, are but partially wooded, and consist of alluvial deposits (sand, gravel, black-earth, bog-earth, &c.), all of comparatively recent formation.

Sternbérgia (after Sternberg).—An assemblage of singular stems occurring in the sandstones of the Coal-measures, and presenting the appearance of a vast number of plates, or short joints held together by a central axis. Some of them are striated longitudinally, others not; and many are evidently the detached central piths of other plants, and not independent stems.

Sternum (Lat.)—The breast-bone; whose form in most vertebrate families is a good anatomical criterion.—**Sternal,** of or belonging to the breast.—**Sterno-costal,** belonging to the region of the ribs attached to the sternum.

Stigmária (Lat. *stigma*, a dot or puncture).—An extensive assemblage of root-stems, characteristic of and peculiar to the Carboniferous system, and so named from their regularly pitted or dotted surfaces—each puncture or areola representing the attachment of a long, slender, succulent radicle. For a long time the true nature of *stigmaria* was unknown, and as there is nothing analogous in existing nature, the earlier observers busied themselves with ingenious speculations, which ended only in a name; hence the numerous designations—*ficoidites, variolaria, phytolithus, lithophyllum*, &c.—by which the organism has been successively known. *Stigmaria* is now ascertained to be the root of *sigillaria, lepidodendron*, &c., and usually occurs in the shale or ancient mud in which it grew, as an underground stem less or more cylindrical, generally compressed, studded with circular pittings or areolæ arranged in spiral order round the stem; these areolæ often denuded, but frequently having the long succulent tubular radicles attached. In most instances the main roots have central or sub-centrical piths, or woody axes, and where the matrix is sufficiently preservative, a thick finely-corrugated bark makes its appearance—though generally converted into a film of coal. When found in attachment with the *sigillaria* trunk, four or more main roots strike down into the soil, these speedily bifurcate and spread out horizontally, bifurcating again and again, till they terminate at a distance (often of twenty-five feet) in an obtuse-growing point. Where the underground root and aërial stem meet, the peculiar markings both of stigmaria and sigillaria are usually indistinct, and it is not till beyond the first bifurcation that the regular areolæ and their attached radicles make their appearance. As there are several species of sigillaria and lepidodendron, so we are presented with several stigmaria—the specific distinctions consisting chiefly in the forms of the

areolæ and the attached radicles. In some the areolæ are distinctly stellate or star-shaped; in others they are so elevated as to become tubercular (hence Brongniart's term *mammillaria*); and in all there is a central speck which passes inwards and connects the succulent radicle with the central woody axis.

Stilbite (Gr. *stilbè*, lustre).—A mineral of the Zeolite family occurring in fissures or druses of granite and primary rocks, but most frequently in traps and amygdaloids. Occurs in broad pyramidal crystals, often in fascicular or diverging groups; also massive, in radiating broad columnar aggregates; or macled. Has a vitreous lustre; is colourless, or more frequently white, red, grey, yellow, and brown. Consists of silica 55.07; alumina 16.58; lime 7.58; soda 1.30; and water 19.30.

Stinkstone (Ger. *stinkstein*).—A name given to fetid limestones—that is, those which, on being struck or rubbed, emit an odour of sulphuretted hydrogen. They are usually of a dark colour, and are often less or more bituminous. Known also as *Swinestone.*

Stiper Stones.—A celebrated ridge in Shropshire, whose stony masses, says Murchison, "appear to the artist like insulated Cyclopean ruins jutting out upon a lofty moorland, at heights varying from 1500 to 1600 feet above the sea." They are fragments of a thick band of siliceous sandstones, which, though in parts veined, altered, and fractured, and occasionally passing into crystalline quartz rock, yet form an integral portion of the overlying schistose formation, and contain fragments of lingulæ. They belong to the Primordial or Protozoic Zone of palæontologists.—See SILURIAN SYSTEM.

Stomápoda (Gr. *stoma*, the mouth, and *pous*, *podos*, the foot).—An order of Crustaceans, so called from the arrangement of their thoracic or true feet in connection with the mouth, which is usually furnished with one or more pairs of jaw-feet—the whole of the thoracic segments being covered or enclosed by the carapace. It includes three families, the *Phyllosomidæ*, the *Squillidæ*, and the *Mysidæ*.

Stone Lilies.—A popular term for the *Encrinites*, in allusion to the resemblance which their rayed receptacles mounted on slender columns bear to the flower and stalk of the lily (Gr. *krinon*, a lily).

Stonesfield Slate.—A member of the lower Oolites, occurring immediately beneath what is known as the "Great Oolite," and celebrated for its being the rock in which English geologists first detected mammalian remains (*Phascolotherium*, &c.) of Secondary epoch. It is a thin calcareous flagstone occurring in two beds, separated by a calcareous sandstone, and is worked for pavement and tiles near the village of Stonesfield in Oxfordshire.

Stourbridge Clay.—A celebrated fireclay occurring in the Coal-measures of Stourbridge in Worcestershire, and largely employed in the manufacture of fire-bricks, pipes, retorts, furnaces, and the like. It is found in a bed about 4 feet thick, and consists of about 64 silica, 23 alumina, 2 oxide of iron, and 10 water.

Strahlstein (Ger.)—Literally "ray-stone;" the German synonym of *Actinote* or *Actinolite* (which see). A variety or sub-species of Hornblende, so called from its occurring in long prismatic crystals, or in radiated columnar masses.

Stratification (Lat. *stratum*, and *facio*, I make).—The general arrangement or condition of all rocks or other matters deposited from suspen-

sion in water—this arrangement being in layers or strata more or less horizontal and parallel to each other. Inclined, vertical, or contorted stratification is the result of convulsions subsequent to the deposition and consolidation of the originally flat strata, and though altering their position, does not affect their character as *stratified* masses. Stratification is thus a mere mechanical arrangement, and not to be confounded with jointing, cleavage, foliation, crystallisation, or other structure arising from the action of chemical or other subtle forces. What is termed "*false stratification*" (that is, when a thick stratum is made up of minor layers, either placed obliquely, waving, or thinning out and thickening irregularly) is a structure arising from currents in the water of deposit—the sedimentary matter being here and there shifted and redeposited, being carried over the sloping edges of submarine banks, layer after layer, or, it may be, blown about and redistributed in minor layers, as we see in sub-aërial sand-hills, or on the shifting banks of rivers and tidal estuaries.—See LAMINATION.

Stratum, plural **Strata** (Lat. *stratum*, strewn or spread out).—When rocks lie in layers, one above another, each layer forms a *stratum*, the whole a series of *strata*. The term evidently implies the idea of being strewn or spread out by some smoothing, levelling, or equalising action, as that of water. Rocks lying in parallel layers are said to be *stratified;* those among which there is no appearance of this arrangement, *unstratified*. Layer, bed, seam, band, &c., are less or more used as synonymous with stratum; but strictly speaking, each has its own proper significance in correct geological description.

Streak.—In Mineralogy, that appearance which the surface of a mineral presents when scratched by a hard instrument; or that appearance which a mineral leaves on a rough porcelain slab when forcibly drawn or stroked along its surface. The *streak*, often differing from the colour, and being pretty persistent, supplies the mineralogist with an easily applied physical characteristic.

Stream-Tin.—A term applied to the rolled fragments of tin-stone or oxide of tin, which occur mingled with gravel and other stony detritus in the gullies and water-courses of Cornwall.—See TIN-STONE.

Stream-work.—In Mining, a place where metalliferous ores are obtained from superficial deposits, and worked by the mechanical application of running water in separating the ore from the sand or gravel with which it may be mingled.

Streptospondўlus (Gr. *streptos*, turned back or reverse, and *spondylos*, vertebra).—A crocodilian saurian of the Wealden epoch, so called in allusion to the peculiar articulating surfaces of the vertebræ. In existing crocodiles the bones of the back or vertebræ are *concavo-convex*, that is, united to each other by a ball-and-socket joint, the convexity being behind. Some of the fossil crocodiles of the tertiary have also this structure of the spinal column; but in every crocodilian of the secondary formations the articulating surfaces of the vertebræ are either flat or concave, except in the *streptospondylus*, whose vertebræ are convexo-concave; that is, the convexity is directed forwards—a position the reverse of the ordinary type.

Striated (Lat. *stria*, a streak).—Streaked or marked with fine thread-like lines running parallel to each other. When the striæ become very marked and decided, the surfaces are said to be *grooved, furrowed*, or *channeled*.

Strike.—The direction or line of outcrop of any stratum. The strike of a stratum is always at right angles to its dip, and *vice versâ*. Thus, if the strike of a stratum run east and west, it must dip either to the north or south; or if we find any stratum dipping to the east, we may be sure that its outcrop has a north and south direction.

String.—In Mining, a small narrow branch of a metalliferous vein; hence certain ores are spoken of as occurring in "threads and strings."

Strobilítes (Gr. *strobilos*, a fir-cone).—A generic term for certain coniferous cones, with tapering truncated scales, occurring in the Coal, Lias, and other formations. The term may be held, in the mean time, for the reception of all fossil fruits that are evidently coniferous.

Stromatólogy (Gr. *stroma*, stratum).—A term proposed to embrace "the history of the formation of the stratified rocks," with all that relates to their succession and organic remains, in contradistinction to PETRALOGY and LITHOLOGY, which see.

Strómnite.—Known also as *Barystrontianite;* a variety of Strontianite or carbonate of strontian, so called from Stromness in Orkney, where it occurs in yellowish-white, semi-translucent masses, with a faint pearly lustre and crystalline structure. Consists of 68.6 carbonate of strontian, 27.5 sulphate of baryta, and 2.6 carbonate of lime. Supposed to be a mere admixture of strontianite and barytes.

Strongylóceros (Gr. *strongylos*, rounded, and *keras*, horn).—A species of gigantic deer, found in pleistocene tertiaries and bone-caves, rivalling the *megaceros*, or gigantic Irish deer, in bulk; but having, as the name indicates, antlers not palmated, but of the type of the existing red-deer.

Stróphodus (Gr. *strophao*, I twist, and *odous*, tooth).—A genus of large, flat, oblong cestraciont fish-teeth, much resembling *Psammodus*, but having a twisted instead of a punctated or sandy appearance on the grinding surfaces. They are common in the Lias, Oolite, and Chalk.

Structure.—A term applied in Geology and Mineralogy to denote the form or condition in which the component parts of rock-masses are arranged. Thus we say that certain sandstones have a fissile or laminated structure, that certain basalts have a columnar structure, and that the structure of granite is tabular or cuboidal. *Structure*, in fact, refers to the mode in which a rock is aggregated in the mass; *texture*, on the other hand, refers to the manner in which its component particles are internally arranged. Thus, on examining a granite quarry, we find the rock arranged in large tabular or square-like masses—this is its structure; on breaking one of these blocks we find it hard, close-grained, and crystalline—this is its texture.

Stucco (Ital.)—When the white powder of calcined gypsum (Plaster-of-Paris) is mixed with thin glue instead of water, it forms *stucco*, which is extensively used for casts, mouldings, statuettes, &c.

Stufa.—An Icelandic term for those fissures or orifices in volcanic districts (like Hecla), from which jets of steam issue often at a temperature much above the boiling-point of water.

Stylastrítæ (Gr. *stylos*, a column, and *astron*, star).—Literally "column-stars;" the name suggested by Mr Martin of Derbyshire for the *Encrinites*, in allusion to their form, which is that of a feathery star-fish surmounted on a long jointed stalk or column. The term was rarely or ever used, and is now altogether obsolete.

Stylonúrus (Gr. *stylos*, a writing style, and *oura*, the tail).—A genus of

Crustaceans occurring in the passage-beds between the Upper Silurian and Lower Old Red Sandstone, and exhibiting forms intermediate between the xiphosurous and phyllapod families. They belong to the family *Eurypteridæ;* have the cephalo-thorax much rounded; the eyes central or subcentrical; are furnished with four or five pairs of organs for swimming and prehension; those organs springing from the basal joint of the jaw-feet are long and slender in the two swimming pairs, and short and covered with spines in the prehensile pairs. The thoracico-abdominal segments (twelve in number) are destitute of appendages, and the last terminates in a long caniculated pointed (or style-like) tail; hence the name. The only specimens yet discovered are from the Upper Silurian beds of Lesmahagow, and the flagstone beds of the Old Red in Forfarshire.

Stythe (Sax.)—A miner's term for fire-damp, or rather for the stifling, suffocating odour of choke-damp that follows an explosion of the former.

Sub— (Lat. *sub,* under).—In Geology, as in other branches of natural science, the prefix *sub* is employed to denote a less or inferior degree; as sub-crystalline, less than crystalline; sub-columnar, not distinctly columnar; sub-calcareous, somewhat calcareous. It also applies to position, as sub-cretaceous, under the chalk; sub-aqueous, under the water; subaërial, under the open air, &c.

Sub-Apennines.—An extensive suite of Older and Newer Pliocene beds, which are amply developed along the whole extent of Italy on both flanks of the Apennines, and form a line of low hills between the older chain and the sea. They consist of light-brown and blue marls, covered by yellow calcareous sand and gravel, and frequently attain a thickness of from 1500 to 2000 feet. They were first described by Brocchi under the term "Sub-Apennines;" and though chiefly composed of Older Pliocene strata, the numerous shells they contain demonstrate that they belong in part both to older and newer members of the tertiary series.

Submaríne (Lat. *sub,* under, and *mare,* the sea).—Under the sea: applied to objects that have their place at some depth in the waters of the sea, at the bottom of the ocean, or covered by the waters of the ocean; as "submarine forests," "submarine volcanoes," and other analogous phenomena.

Submérgence (Lat. *submergo,* I plunge under water).—Applied in Geology to all sinkings of the land whereby its surface is brought under the waters of the ocean. Thus we have "submerged forests," "submerged islands," and so forth.

Subsídence (Lat. *sub,* under, and *sido,* I sink or settle down).—The act of sinking or settling down to a lower level. Applied in Geology to sinkings of portions of the earth's crust, which may be either gradual and scarcely perceptible over a long lapse of years, or sudden and destructive as arising from earthquake convulsions.

Subterposition (Lat. *subter,* under, and *positus,* placed).—The order of arrangement in which strata are placed below each other, as *super*-position is the order in which they are arranged above one another.

Suchosáurus (from *suchus* or *suchis,* the name given by Strabo to the sacred crocodile of the Nile).—A provisional genus of Crocodilians founded on certain teeth occurring in the Wealden strata of Tilgate Forest, and distinguished by their form, which is about an inch long, slender, pointed, gently recurved, and compressed laterally with a sharp edge in front and behind.

Sulcated (Lat. *sulcus,* a furrow).—Furrowed; deeply furrowed or channeled; having a deeply-furrowed surface.

Sulphur (Lat.)—One of the elementary substances, occurring in nature as a greenish-yellow, brittle solid; crystalline in structure, and exhaling a peculiar odour when rubbed. It has a specific gravity of from 1.98 to 2.12; is insoluble in water, but dissolves in other liquids, as oil of turpentine and the fixed oils, and especially in the bisulphuret of carbon. It is a non-conductor of electricity, but acquires negative electricity by friction. It melts at a low temperature (234°); and burns with a bluish flame and most suffocating odour. Sulphur occurs abundantly in a free state, chiefly in volcanic districts, where it appears in veins, amorphous masses, in drusy cavities, or mingled with clay and other earthy impurities. It is also extensively diffused throughout the globe in combination with other substances. With the metals it forms their principal ores, as *sulphurets* of silver, lead, zinc, antimony, iron, &c.; and with the earths, as *sulphates* of lime or gypsum, of baryta, magnesia, soda, and the like. It is largely diffused throughout the waters of the ocean in combination with soda, magnesia, &c.; and is present in the structure both of plants and animals. It is largely and variously employed in the arts, for which it is obtained from volcanic districts in a crude state; from deposits such as those of Poland and Gallicia, where it occurs as an ore in combination with clay; or from pyrites, in which it is in chemical union as a sulphuret of iron.

Sunstone.—A familiar term for *Avanturine felspar;* a resplendent variety of Oligoclase, deriving its play of colours from minute imbedded flakes or crystals of iron-glance.

Superficies, Superficial (Lat.)—The external surface of any body; the exterior parts; hence the term "Superficial Accumulations" is applied to those loose and irregular accumulations of soil, sand, gravel, clay, peat-moss, and other detritus, which cover the solid and regularly stratified crust of the Earth.—See tabulations, "Geological Scheme."

Superposition (Lat. *super,* above, and *positus,* placed).—The order of arrangement in which strata and formations are placed above each other. Thus, we speak of the Chalk occurring above the Oolite "in order of superposition," and of the Muschelkalk being in order of superposition above the Bunter-Sandstein. The idea intended to be conveyed is, that every formation is more recent than that on which it lies, and that there is a certain sequence of formations which is never reversed or found out of order, though occasionally some of the members may be absent or wanting in certain localities.

Supra— (Lat. *supra,* above).—A prefix occasionally made use of to denote mere position *above;* as SUPRA-CRETACEOUS, above the chalk,—a term employed by Sir H. de la Beche to embrace all the stratified deposits which occur above the chalk, and equivalent to TERTIARY, which is now universally adopted.

Surbéd.—In Architecture, to set stones on edge, or contrary to their natural bedding in the quarry. Many stones, when *surbedded,* yield to the weather and fall off in thin plates or laminæ.

Surgent (Lat.)—Mounting up; the fifth of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain—the "Mounting Day" of the North American Palæozoics, and the equivalent in part of our Middle Silurians.—See PALÆOZOIC FORMATIONS.

Surtur-Brand.—An Icelandic term for a peat-like variety of brown-coal

or lignite occurring in the Pliocene deposits, and sometimes under the volcanic overflows of that island.

Sussex Marble.—A fresh-water limestone of the Wealden formation, occurring in thin bands in various parts of Sussex (whence the name), and almost wholly composed of the shells of *Paludinæ*, or river-snails. Known also as *Petworth Marble*, which see.

Súture (Lat. *sutura*, a seam; from *suo*, I sew).—A seam; a line of junction. Applied in Anatomy to the lines of junction between the several portions of the cranium—these lines presenting a jagged or zigzag appearance like the cross stitches of a seam.—**Sutural** junctions are common in the hard structures of animals; *e.g.*, the bones of the head, the chambers of cephalopod shells, &c.

Swanage Crocodile.—The popular term for the *Goniopholis*, whose remains were first discovered in the Purbeck beds of Swanage.—See GONIOPHOLIS.

Swinestone. — The name given by Kirwan to those fetid varieties of limestone better known as STINKSTONE, which see.

Sýenite (from *Syene* in Upper Egypt).—A granitic rock composed of felspar, quartz, and hornblende; and so called from its being obtained by the ancient Egyptians for their monumental purposes from Syene. Any granitic rock in which hornblende predominates is termed *syenitic*, as syenitic or primitive greenstone.

Syépoorite.—A sulphuret of cobalt, of a steel-grey or yellowish colour, found in primary rocks along with pyrite and chalcopyrite at Syepoor, near Rajpootanah, in North-West India. It consists of 64.64 cobalt, and 35.36 sulphur; and is employed by the Indian jewellers to give a rose colour to gold.

Sýnchronous (Gr. *syn*, together, and *chronos*, time).—Occurring at the same time; contemporaneous; of the same date or epoch.

Sýncline, Synclinal (Gr. *syn*, together, and *clino*, I bend).—Applied to strata that dip from opposite directions inwards, like the leaves of a half-opened book; or which incline to a common centre, forming a trough or basin-shaped hollow. *Synclinal axis*, the line of direction in which such a trough or basin trends; the converse of *Anticlinal axis*, which see.

Syringodéndron (Gr. *syringx*, a pipe or channel, and *dendron*, tree).—The generic term applied by Sternberg to the *Sigillaria* (which see), in allusion to the channeled or pipe-like flutings of its trunk.

Syringopóra (G. *syringx*, a pipe, and *pora*, pore).—Literally "pipe-pore;" a genus of palæozoic corals abounding in the Carboniferous limestone, and bearing a general resemblance to the Organ-pipe Coral of Australian seas. The polypidom consists of a cluster of long, cylindrical, vertical tubes, distant from each other, and connected by transverse tubular processes; the cells are deep and radiated by numerous lamellæ. Formerly known as *Tubipora* or *Tubiporites*.

System (Gr. *syn*, together, and *stemi*, to stand).—Groups of objects or occurrences, having such relations as permit them to be classed together, constitute a system. In Geology, the term is usually applied to such series or groups of strata as are in intimate relation, chronologically speaking, and are characterised in the main by a marked similarity of fossil forms. Thus the various groups—Lower coal, Mountain limestone, Millstone grit, and Upper coal—which compose the *Carboniferous System*, though each lithologically very distinct, are yet intimately connected in

unbroken sequence; and though each has forms of life peculiar to itself, yet over the whole there runs such a facies of resemblance that there can be no doubt of their all belonging to one great Life period or System.

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Tábasheer (Persic).—Literally "bamboo milk;" a siliceous secretion occurring at the joints of the bamboo, and so called from its being occasionally found of a white milky consistence. It occurs more frequently in starch-like concretions (called by the Indians "bamboo camphor"), and is a pure silex like the thin pellicle which forms the outer coating of the bamboo and many of the grasses.

Table-Land.—In Geography, any flat or comparatively level tract of land considerably elevated above the general surface of a country. While *plains* and *valleys* are low-lying expanses but little broken by elevations and depressions, *table-lands* and *plateaux* are similar tracts, often of great altitude; as the table-land of Mexico, rising about 6000 feet above the sea; the table-land of Central Spain, 2200 feet in height; and the plateaux of Central Asia, rising successively from 3000 to 6000, 12,000 and 16,000 feet above the sea-level. Such elevated plains are accompanied by important physical and vital results, conferring on areas under the tropics the climate, flora, and fauna of temperate regions, and bequeathing to temperate areas all the phenomena of arctic regions.

Table-Layers.—That peculiar structure in certain granites, greenstones, porphyries, and other igneous rocks, which gives to their sections the appearance of stratification, and which is termed by some geologists *pseudo-strata*, and by others the *stratiform structure*. In many instances this division into parallel planes seems to be the result of *jointing*, or some analogous structure, on a large scale; in others, it is merely the mark of the *successive overflows* of igneous matter which constitutes the mass.

Tabréez Marble.—A beautiful transparent limestone, composed of innumerable laminæ, thin as paper, and formed by deposition from a celebrated calcareous spring near Maragha.

Tábular.—Composed of, or arranged in, square blocks or *table-like* masses, as many granites and greenstones. The "tabular" frequently passes into the "columnar" structure, and *vice versa*.

Tábular Spar.—The *prismatic augite spar* of Mohs, the *Schaalstein* of Werner, and *Wollastonite* of other mineralogists.—See WOLLASTONITE.

Táchylite (Gr. *tachys*, quick, and *lithos*).—A black vitreous mineral of the hornblende family, occurring in amorphous fragments in the softer trap-rocks, and nearly related to obsidian and isopyre. The name has reference to the ease with which it fuses under the blowpipe; same as the *hyalomelan* or black-glass of Hausmann.

Tæniópteris (Gr. *tainia*, a riband, and *pteris*, fern).—A genus of elegant ferns occurring in the Lias and Oolite, and so named from their long, narrow, tapering, riband-like leaves, which are furnished with a strong midrib, and have secondary bifurcating veins almost at right angles to the midrib. On some specimens the *sori* or seed-specks are still visible,

thus bringing them in pretty close affinity with the simple-leaved *aspidiums* and *polypodies* of our own day.

Talc (Ger. *Talk*).—A common magnesian mineral occurring in masses, composed of thin, crumpled laminæ or foliæ, or in scaly aggregates like mica, which it also often resembles in colour. It is easily distinguished, however, from mica in being much softer, and, though flexible, not elastic. Like other magnesian minerals, it feels greasy; and, though varying in colour, its prevalent hue is a greenish or yellowish white, lustre pearly, transparent in very thin plates, and infusible. Its chemical composition is, 63.9 silica and 36.1 magnesia; but a part of the latter is often replaced by iron protoxide. Talc occurs not only as a simple mineral, but enters with quartz, mica, chlorite, and felspar into the composition of many of the crystalline rocks, as talc-schist, chlorite-schist, steatite, serpentine, &c. Common talc is used for crayons, for polishing stones, for crucibles, as a fulling material or absorbent of grease, and also in porcelain mixtures.—See the following compounds.

Tálcite.—An occasional synonym of *Phollerite* or *Nacrite,* a hydrated silicate of alumina, occurring chiefly in granitic veins.—See NACRITE.

Talcose.—Applied to rocks which have a talc-like aspect, or which contain talc as a notable ingredient of their composition; *e.g.*, chlorite-schist, talc-schist, steatite, serpentine, potstone, and the like.

Talcose Granite.—A granitic rock composed of felspar, quartz, and talc or chlorite; known also as PROTOGENE, which see.

Talc-Schist.—A glistening schistose rock of the metamorphic series, consisting of talc and quartz, arranged in foliæ more or less crumpled; of various colours, but greenish hues prevail; has a greasy feel, and generally associated with mica-schist, chlorite-schist, steatite, and serpentine.

Tallow, Mineral.—One of the mineral resins, or hydrocarbons; a light, soft, fatty substance of a greenish-yellow colour; and usually known as HATCHETINE, which see.

Tálus (Lat.)—In Fortification, the outside of a wall or rampart which slopes inward and upward, the wall diminishing in thickness as it rises in height. Adopted in Geology to designate the sloping mounds of detritus which accumulate at the bases of cliffs and precipices, being derived from their weathered and wasted surfaces. In many instances, where the cliffs are high and the rocks of a wasting nature, the talus in the course of ages assumes gigantic dimensions, and its long sloping surface becomes a characteristic feature of the landscape.

Tánnin.—Impure or crude tannic acid, occurring in the bark of oak and other trees. It is a powerful antiseptic; hence this property in *peat-mosses,* &c., derived mainly from the accumulated decay of vegetable substances.

Tántalite.—Known also as *columbite;* the ore of the metal tantalum or columbium, occurring in prismatic crystals, or in granular masses, in the granites of Finland. When recently broken, tantalite is of a dark bluish-grey, or iron-black colour; has a specific gravity from 7. to 8.; and consists of about 84.5 tantalic acid, 14.5 iron protoxide, and 1 protoxide of manganese, with a trace of oxide of tin. Those varieties which contain upwards of 5 per cent tin oxide are termed *Cassitero-tantalites.*

Tántalum.—The metal extracted from *tantalite* and *yttro-tantalite.* It is of a dark-grey colour, very dense, and difficult of fusion. Said to derive its name from the insolubility of its oxide in acids, in allusion to

the fable of Tantalus, who, though up to the chin in water, could not drink.

Tapíridæ.—The tapir family; a group of pachydermatous animals, having thick massive bodies, short semi-prehensile trunks, three pair cutting and one pair canine teeth, very short tails, four-toed forefeet and three-toed hind-feet; having much the aspect of a pig, but about the size of an ass; and represented by the tapir of South America. They are sometimes marked as a sub-family of the *Elephantidæ*, under the term *Tapirina*, which includes only two or three living species, but embraces numerous fossil congeners from the tertiaries of Europe, as *Palæotherium, Lophiodon, Coryphodon*, &c.

Tap-root.—In Botany, the main root of a plant which passes directly downwards, as a continuation of the äerial stem or trunk.

Tar, Mineral.—A variety of bitumen or inspissated petroleum, found oozing from the rocks of different formations, but often from limestones in connection with lignite or coal, and occasionally in volcanic districts.—See BITUMEN.

Tarágmite Series (Gr. *taragma*, disturbance).—A term employed by Dr Fleming in his "Lithology of Edinburgh," to embrace the Boulder Clay, or lowest stage of the modern epoch, as "having been formed when violent aqueous movements were taking place, and probably at a period when the state of our island was widely different from the present." The Brick-clays which lie above, he terms the *Akumite* or tranquil series; and the more superficial deposits, the *Phanerite* or evident series.—See MODERN EPOCH.

Tardigráda (Lat. *tardus*, slow, and *gradus*, a step).—Literally "slow-walkers;" a term variously employed by zoologists, but first used by Cuvier to designate the *Sloths* of South America, in allusion to their slow and difficult mode of progression while on the ground.—See BRADYPIDÆ.

Tarnowitzite.—A variety of *Arragonite* from Tarnowitz in Upper Silesia, containing from 3 to 4 per cent of carbonate of lead.

Tastes of Minerals.—As a means of distinguishing many of the soluble minerals, the taste has been employed; hence mineralogists speak of the *astringent*, like vitriol; *sweetish astringent*, like alum; *saline*, like common salt; *alkaline*, like soda; *cooling*, like saltpetre; *bitter*, like Epsom salts; *sour*, like sulphuric acid, and so on.

Taxítes (Lat. *taxus*, the yew-tree).—The generic term for such coniferous remains as are evidently allied to the yew-tree. They occur in the Oolite, but chiefly in the Tertiary lignites.

Taxodítes.—Fossil plants found in Tertiary deposits, and allied to the existing *Taxodium*, or deciduous cypress of North America; a tree which often attains most gigantic dimensions in the southern swamps of that country.

Taxóxylon (Lat. *taxus*, the yew, and *xylon*, wood).—A name given by Unger to certain yew-like twigs and branches from the upper tertiaries of Europe.

Tchornozem (Tart.)—A local name for the black earth of the south of Russia, which covers the whole of the Aralo-Caspian plain—a range of country embracing not less than 100,000,000 acres. It varies from 4 to 20 feet in thickness; is remarkable for its fertility; and consists chiefly of silica with a little alumina, lime, and oxide of iron, and about 7 per cent of carbonaceous or vegetable matter, of which no less than 2.45 is nitrogen gas!

This remarkable deposit covers every other in the district, and is evidently of alluvial origin.

Teeth (Teut. *tunth;* allied to the Latin *dens,* and Greek *odous*).—From their hardness and durability the teeth of animals are generally well preserved in stratified deposits, and are not unfrequently the only fossilised remnants of the creatures to which they belonged; hence their importance to the palæontologist. They consist of three tissues—*dentine,* which forms the body of the tooth; *cement,* which constitutes the harder outer coating; and *enamel,* which lies between the dentine and cement, and is the hardest of all known animal tissues. The teeth of different classes differ in composition, size, form, structure, and so forth, according to the habits and requirements of the animal;—some being fitted for cutting and tearing flesh, others for gnawing and crunching bones; some for grinding and pounding the harder vegetable substances, others for crushing softer tissues; some for seizing and retaining such slippery prey as fishes, while others are fitted for rasping and nibbling the bark of trees, transfixing insects, crushing shell-fish, or it may be serving as organs of offence and defence, or assisting in progression, climbing, anchoring, and the like. Whatever their function, it is usual to divide them into *incisors* or front cutting teeth, *canines* or side seizing and tearing teeth, *premolars* and *molars,* or true grinding teeth;—and according to the requirements of the the animal, one or other, or even all, of these divisions may be suppressed, or one set enormously developed into "tusks," at the expense of the rest. This idea of answerable teeth in the different classes of animals has given rise to what is termed "dental formulæ" for each class; *i* standing for incisor, *c* for canine, *p* for premolar, and *m* for molar. Thus, in man, the number of these teeth on each side of both jaws is represented by the following brief formula:—$i\ \frac{2.2}{2.2};\ c\ \frac{1.1}{1.1};\ p\ \frac{2.2}{2.2};\ m\frac{3.3}{3.3} = 32.$ Hence, knowing the functional characteristics—the size, form, structure, &c.—of each class of animals, the palæontologist can often, by microscopic sections and rigid comparisons, arrive at sound conclusions as to the affinity of extinct animals, whose sole remains consist of a few teeth, or, it may be, even the fragment of a single tooth. Thus fish teeth are readily separable from reptilian teeth, and reptilian from mammalian; while each great family of fishes, reptiles, and mammals have their permanent dental characteristics which the skilful odontologist can easily detect. For the specialities of the subject see Owen's *Odontography,* and his article *Odontology* in *Encyclopædia Britannica.*

Teleosáurus (Gr. *teleos,* complete, and *sauros,* lizard).—A genus of Crocodilian reptiles belonging to the oolitic period, and characterised by their having (like the recent Gavial) long slender muzzles, with numerous pointed teeth, but differing in having the nasal apertures terminating in *two* orifices in front of the nose, and not blended into *one* opening as in the recent species. The osseous scutes of the dermal covering, the skull and jaws with teeth, the vertebral column, and many other bones, have been found, indicating four or five species at least, the individuals of which varied from three to fifteen or eighteen feet in length.—See STENEOSAURUS.

Telérpeton (Gr. *tele,* afar off, remote, and *herpeton,* reptile).—A small lizard-like reptile from the upper Old Red Sandstone of Morayshire, and so named in allusion (palæontologically speaking) to its remote antiquity. Its osteology seems to denote a blending of Lacertian characters with those

of the Batrachians. The Triassic affinities of *telerpeton, stagonolepis,* and other reptilian remains from the sandstones of Elgin and Lossiemouth, have recently suggested the possibility of these *strata* being *Triassic* or Liassic, and not Old Red Sandstone, as has hitherto been supposed. The lithological evidence is still, however, in favour of their upper Devonian origin.

Tellúrium (Lat. *Tellus,* the goddess of the earth).—A rare metal of a brilliant tin-white colour; very easily fusible, and usually found massive and disseminated along with quartz, gold, and iron-pyrites, in some of the mines of Germany and Hungary. It was discovered and named by Klaproth in 1782, but has not been applied to any useful purpose. The native metal is rarely found pure, but contains a minute per-centage of gold or of iron, and the ores enumerated by mineralogists are complex and uncertain admixtures, as *graphic-tellurium,* consisting of tellurium, gold, silver, and lead; *white-tellurium,* of tellurium, gold, silver, lead, and sulphur; and *black-tellurium,* of copper in addition to the preceding constituents.

Temperature of the Earth.—As one of the orbs of the solar system, the Earth has a variable and irregular *surface temperature;* it has also a *temperature peculiar to the rocky crust;* and judging from volcanic action, hot springs and the like, there is also a higher and more remarkable *interior or central temperature.* Without entering upon any questions as to the exact proportions that exist between the solid rocky crust accessible to our investigations, and the inaccessible interior, of which we can know nothing by direct observation, we know enough of the Earth's Temperature to warrant the following general conclusions:—1. That the surface temperature is mainly derived from the sun, and that, though variable and irregular during any one season, it is, on an average of many seasons, capable of being laid down with considerable certainty; 2. That the temperature of the crust, as depending on external heat, is also variable to the depth of from 60 to 90 feet, but that at this limit it remains stationary; 3. That downwards from this invariable stratum the temperature increases (as has been proved by experiments in mines and Artesian wells) at the ratio of one degree for every 50 or 55 feet, and that at this rate a temperature would soon be reached sufficient to keep in fusion the most refractory rock-substances; 4. That this high internal temperature is apparently the cause of hot springs, volcanoes, earthquakes, and other igneous phenomena, which make themselves known at the surface; and lastly, That intense as the interior heat may be, the surface of the globe is scarcely, if at all, affected by it (according to Fourier, only $\frac{1}{17}$th of a degree), owing to the weak conducting properties of the rocky crust.

Temperature of the Ocean.—Respecting the temperature of the ocean, though as yet few observations have been made, we know that it is more equable than that of the land; that at the depth of 60 fathoms or so it is pretty constant; that it is colder in summer than the surrounding atmosphere of any contiguous district, while in winter it is always several degrees higher—thus exercising the function of a great storehouse of heat for modifying and equalising the climates of the adjacent lands. Its *mean temperature,* from such experiments as have been made, is estimated at $39\frac{1}{2}°$, or $7\frac{1}{2}°$ above the freezing-point of pure water, and as nearly as possible at the point of its mean density. Its *surface temperature* varies of course with the latitude—shading off from about 80° at the equator to 40° at the 56th parallel, and thence down to perpetual ice at either pole; that is, laying aside the problematical existence of an open sea surrounding the North Pole, as has been affirmed by some of our Arctic voyagers.

Tenácity (Lat. *tenax*, tough, capable of holding together).—The degree of force with which particles of bodies cohere or are held together. Applied especially to metals which can be drawn into wire, as gold, silver, copper, iron, &c.

Ténnantite (after Mr Tennant, the mineralogist).—A variety of grey copper ore (sulphuret of copper) occurring in the mines of Cornwall along with common copper-pyrites. It is distinguished perhaps by its large percentage of arsenic—ranging from 10 to 20 per cent of the whole.

Tentácula (Lat. *tentaculum*, from *tento*, I feel by touching frequently, and that from *tendo*, I stretch forth). — Feelers; slender, flexible, and often jointed organs, possessed by many tribes of animals, and used for the purposes of feeling, exploring, prehension, locomotion, or for attachment to other bodies—*e.g.*, the tentacula of polypes, sea-anemones, cuttlefishes, and the like.

Tentaculítes (Lat. *tentacula*, feelers).—A genus of annulated feeler-like organisms occurring in Silurian strata; of annelid origin, and probably allied to Serpula. "They were annulated, shelly tubes, of a highly complex structure," says Mr Salter, "and not jointed tentacles or stems."—See CORNULITES.

Téphroite (Gr. *tephros*, ash-coloured).—Anhydrous silicate of manganese, occurring in distinct crystalline and granular masses, of an ash-grey colour (whence the name), and consisting of 30 silica and 70 protoxide of manganese, with traces of iron and lime.

Terebrátula (diminutive of *terebratus*, perforated, in allusion to the perforation of the beak).—A genus of brachiopod bivalves, of which about 100 species have been enumerated from the Silurian system upwards, and a few species of which are still existing as deep-sea molluscs (from 90 to 250 fathoms). The genus has been taken as the type of the family *Terebratulidæ*, which is characterised by the shell being minutely punctate; usually round or oval, smooth or striated; ventral valve with a prominent beak and two curved hinge-teeth; dorsal valve with a depressed umbo; a prominent cardinal process between the dental sockets, and a slender shelly loop. The family embraces such genera as *Terebratula*, *Terebratella*, *Argiope*, *Thecidium*, and *Stringocephalus*, together with many doubtful sub-generic or merely specific forms.

Terédina.—An extinct genus of boring molluscs, whose perforations are common in the drift-wood of the London Clay. "The calcareous tube of the *teredina* was united, and, as it were, soldered on to the valves of the shell, which cannot therefore be detached from the tube, like the valves of the recent *Teredo*;" which see.

Terédo (Gr. *teredon*, from *tereo*, I bore).—A genus of marine bivalves belonging to the *Pholas* family, and so called from their habit of boring into and taking up their lodgment in wood. The animal is elongate and worm-like; hence the familiar designation of "ship-worm;" and the shell is somewhat globular, open in front and behind, and lodged at the inner extremity of a tubular, straight, or flexuose burrow, partly or entirely lined with shell. About twenty living species of *teredines* are known; and about the same number have been found fossil from the Lias upwards. Fragments of drift-wood drilled by the *Teredina* (an extinct genus) are common in the London Clay.

Terra Cotta (Ital.)—Literally "baked earth;" a term applied to a kiln-burnt ware prepared from the purest kinds of fire-clay, and usually

employed for vases, mouldings, and other architectural ornaments. "The best *terra-cottas*," says Ansted, "are made in France, and the manufacture has there attained a high state of perfection. Various attempts in England have met with partial success; the unequal contraction of the material being a difficulty rarely surmounted."

Térra Ponderósa (Lat.)—Literally "heavy earth," another name for heavy spar or *Barytes*, which see.

Terra Siénna.—A yellow-coloured ochraceous earth or bole, used as a pigment; and so called from its being brought from Sienna. In its natural state it is known as *Raw Sienna;* and when roasted and rendered redder in colour it is called *Burnt Sienna.*

Terrace.—Any shelf or bank of land having a uniformly flat or level surface. Such terraces are produced by the operations of water, and are either ancient sea-margins (*raised beaches*), or *lake* and *river terraces;* and point to a time when the valleys in which they occur were either occupied by lakes at these heights, or had their whole surfaces at these levels, and before their rivers had worn their channels down to lower depths.

Terrátolite.—Glocker's term for *Hard lithomarge*—the *terra miraculosa Saxoniæ* of old authors.—See LITHOMARGE.

Terrícola (Lat. *terra*, the earth, and *colo*, I inhabit).—An order of Annelids which, like the earth-worms, burrow in the earth; hence the name. How far some of the "annelid tracks" and "annelid burrows" of the stratified systems may have resulted from the operations of terrestrial worms, palæontology has not yet determined.

Tertiary (Lat. *tertius*, third).—Of or belonging to the tertiary system—the third or upper great division of the stratified systems, as distinguished from Secondary and Primary; hence we speak of "tertiary epoch," "tertiary fossils," "tertiary strata," &c.—See TERTIARY SYSTEM.

Tertiary System.—The earlier geologists, in dividing the stratified crust into primary, secondary, and tertiary formations, regarded as *Tertiary* all that occurs above the Chalk. The term is still retained, but the progress of discovery has rendered it necessary to restrict and modify its meaning. Even yet the limits of the system may be said to be undetermined—some embracing under the term all that lies between the Chalk and Boulder-drift, others including the Drift and every other accumulation in which no trace of man or his works can be detected. Palæontologically speaking, much might be said in favour of both views; but the difficulty of unravelling the relations of many clays, sands, and gravels, makes it safer to adopt, in the mean time, a somewhat provisional arrangement, and to regard as TERTIARY all that occurs above the chalk till the close of the drift, and as POST-TERTIARY every accumulation which appears to have been formed since that period. Adopting this view, we have the following intelligible synopsis:—

POST-TERTIARY.	RECENT and SUPERFICIAL ACCUMULATIONS occurring above the boulder-drift.	
TERTIARY.	PLEISTOCENE	Boulder or Glacial drift.
	PLIOCENE	Mammaliferous, Red and Coralline crag of Suffolk, &c.
	MIOCENE	Faluns of Touraine, Molasse of Switzerland, and part of Vienna Basin.
	EOCENE	Strata of London and Paris Basins.

As in other systems, so in the Tertiary, the fossils of the older strata differ considerably from those of the newer; and thus the whole might be conveniently grouped into Lower, Middle, and Upper. Palæontologists, however, have chosen a somewhat different nomenclature, and, taking the percentage of fossil shells as their guide, have adopted the scientific divisions above tabulated. Thus *Eocene* (*eos*, the dawn, and *kainos*, recent) implies that the strata of this group contain only a small proportion of existing species, which may be regarded as indicating the dawn of existing things; *Miocene* (*meion*, less) implies that the proportion of recent shells is less than that of extinct; *Pliocene* (*pleion*, more), that the proportion of recent shells is more or greater than that of the extinct; and *Pleistocene* (*pleiston*, most), that the shells of this group are mostly those of species inhabiting the present seas. This nomenclature is now in general use by English geologists, though it must be confessed that the progress of fossil discovery has long since rendered the divisions lower, middle, and upper, more appropriate, and much less liable to mislead. For further details and foreign equivalents, see tabulations, "Geological Scheme."

Tessellâted (Lat. *tessela*, dim. of *tessera*, a cube or small square of wood used in chequer-work).—Divided into squares or chequers, either by different colours, or by the crossing of striæ; chequered; arranged in square or lozenge-shaped compartments.

Testâcea (Lat. *testa*, a shell).—A general designation for those molluscous animals that are furnished with a shelly covering, as the oyster, periwinkle, &c., in contradistinction to those which are naked or merely covered with a tough coriaceous tunic (*tunicata*).

Tetra (Gr., four).—A frequent prefix in scientific nomenclature, as *tetragonal*, four-cornered; *tetradactylous*, having four toes, &c.

Tetracâulodon (Gr. *tetra*, four, *caulos*, stalk, and *odous*, tooth).—Literally "four tusk-teeth;" a name proposed by Dr Godman as a generic distinction for some elephantine jaws of the tertiary period, which have two short tusks in the lower jaws in addition to the long tusks of the upper jaws. Professor Owen and others regard the *tetracaulodon* of Dr Godman as the immature state of the MASTODON GIGANTEUS—the lower tusks being merely milk-teeth, which were lost as the animal became adult. Some palæontologists, however, still retain the distinction, and enumerate several species of the genus *Tetracaulodon.*

Tetrâdymite (Gr. *tetra*, four).—Telluric-bismuth; so called from the quadruple macles in which its crystals usually appear. It also occurs massive and granular foliated; of a brilliant steel-grey colour; and consists of 60.00 bismuth, 34.60 tellurium, and 4.80 sulphur.

Tetragonólepis (Gr. *tetra*, four, *gonè*, corner, and *lepis*, scale).—Literally "four-cornered scale;" a Liassic fish somewhat similar to the DAPEDIUS (which see), but differing in the characters of its scales and teeth, and belonging to the *Pycnodont* family.

Tetralóphodon (Gr. *tetra*, four, and *lophos*, ridge).—Literally "four-ridged;" one of Dr Falconer's sub-genera of Mastodons, which he divides into *trilophodon* and *tetralophodon*, according as the crowns of their molar-teeth exhibit *three* or *four* pap-like transverse ridges with intervening depressions.

Tetrapodíchnites (Gr. *tetra*, four, *pous, podos*, foot; and *ichnon*, a footprint).—The footprints of four-footed creatures, as batrachian reptiles, and other terrestrial saurians.—See ICHNITES.

Tetrápterus (Gr. *tetra*, four, and *pteron*, wing or fin).—Four-finned; a genus of fossil fishes peculiar to the Chalk formation, and characterised, according to Agassiz, by the close apposition of their pectoral and ventral fins.

Thalactroides.—Fossil fruits belonging to plants of the order *Ranunculaceæ*, and related to *Thalictrum* (Meadow-Rue); hence the name. They have been found in the eocene strata of France and England.

Thalassiophýtes (Gr. *thalassios*, belonging to the sea, and *phyton*, a plant).—Literally "sea-plants;" a term occasionally employed to embrace the entire vegetable productions of the ocean—its deep waters, its rocks and its shores.

Thécodont (Gr. *thekè*, a sheath, and *odous*, *odontos*, tooth).—In expressing the leading modifications in the mode of attachment of the teeth among the inferior or squamate saurians, Professor Owen makes use of the following terms: viz., *acrodont* (*akros*, the summit), those which have the teeth anchylosed to the summit of the alveolar ridge; *pleurodont* (*pleuron*, the side), those which have them anchylosed to the bottom of an alveolar groove, and supplied by its side; and *thecodont*, those which have the teeth implanted in sockets, either loosely or confluent with the bony walls of the cavity.

Thecodontosâurus (Gr. *thekè*, a sheath or socket, and *odous*, *odontos*, tooth).—Literally "socket-tooth saurian;" a type of reptile apparently peculiar to the Permian epoch; and so called from having the teeth implanted in distinct sockets, as in the crocodile. The remains were first discovered by Dr Riley and Mr Stutchbury in the dolomitic conglomerate of Somersetshire, and consist of jaws, teeth, vertebræ, and bones of the extremities; but similar forms have since been obtained from the Permians of Russia, Germany, and Chatham in North Carolina. "The teeth," says Dr Mantell, "are pointed, compressed laterally, trenchant, and finely serrated on the edges. These reptiles, in their thecodont type of dentition, biconcave vertebræ, double-headed ribs, and proportionate size of the bones of the extremities, are nearly related to the Teleosaurus of the Oolite; but combine a lacertian form of tooth and structure of the pectoral arch with these crocodilian characters; and the bodies of the vertebræ have a series of ventricose excavations for the spinal chord, instead of a cyclindrical canal."

Thélodus (Gr. *thelè*, a little nipple, and *odous*, tooth).—A fish of the Silurian bone-bed; so called from its peculiar mammillated teeth. Nothing is yet known of its true affinities.

Thenárdite (after M. Thenard).—Anhydrous sulphate of soda occurring in crystalline crusts, of a vitreous white colour, at the salt-springs of Espartinas, near Madrid, where it is deposited from the waters during the summer months. It is used for preparing soda.

Thermal (Gr. *thermé*, heat).—Warm; applied to hot springs and other waters whose temperature exceeds 60° Fahrenheit.

Thermonátrite (Gr. *thermê*, heat, and *natron*, crude carbonate of soda).—Haidinger's term for prismatic carbonate of soda, consisting of 50.1 soda, 35.4 carbonic acid, and 14.5 water, with slight earthy impurities. It occurs with natron in the lakes of South America, the Egyptian desert, &c., and is deposited from their waters during the warm season; whence the name. According to Haidinger, a saturated solution of soda at a temperature of 77° to 99° Fahr., and cooling slowly, forms crystals of *thermo-*

natrite; whereas a less saturated solution at a lower temperature forms crystals of *natron.*

Thin-out.—A stratum is said to "thin-out" when it becomes thinner and thinner, as you trace it in any direction, till it finally disappears, and its place is taken by some other stratum. A *thin-out* is, in fact, the natural termination of every stratum, unless its edge has been brought to the surface by subterranean disturbance, and then it is said to *crop-out.*

Thómsonite (after Dr Thomson the well-known chemist).—A mineral of the zeolite family occurring in rectangular prisms in druses, in fan-shaped, or in radiated aggregates of a whitish colour; and found with calc-spar and other zeolitic minerals in cavities in amygdaloid, basalt, greenstone, and old lavas. Known also as *Comptonite,* and consists of silica 38.5, alumina 30.6, lime 12.6, soda 4.8, and water 13.15.

Thorína.—The protoxide of the metal *thorium,* an earth discovered by Berzelius in the mineral thorite; *thorium* being named after the Scandinavian deity *Thor.*

Thórite.—A hard, brittle, reddish-brown, massive mineral occurring in the Syenites of Norway, and yielding to analysis about 58 per cent of the earth *Thorina.*

Thrissonótus (Gr. *thrix, thrissos,* bristle, and *notos,* back).—Literally "bristle-back;" a genus of fishes peculiar to the lias and lower oolite, and characterised by the peculiarity of their dorsal fin.

Thríssops (Gr. *thrix,* bristle, and *opsis,* appearance).—One of Agassiz' genera of fossil fishes, occurring in the lias and oolite, and so named from the long bristle-like character of their fin-rays.

Throw.—A miner's term for *fault,* because of its displacing the strata—"throwing" them up on one side and down on the other. The "throw" is the amount of vertical displacement occasioned by a fault; hence the fault is said to be an *upthrow* or *downthrow,* an *upcast* or *downcast,* according to the side from which it is viewed.

Thuites.—A genus of coniferous plants occurring in fragments in the shale and coal of the oolite, and so called from the resemblance of their imbricated stems and terminal twigs to those of the modern *Thuja* or *Thuya,* better known as the *Arbor-vitæ.*

Thúlite.—A rare variety of epidote of a rose or peach-blossom colour, occurring in granular masses in the granites of Svuland in Norway.

Thúmmerstone or **Thummerstein.**—The *Axinite* of other mineralogists; so called by Werner from its occurring in the crystalline rocks of Thum in Saxony.

Thýlacoléo (Gr. *thylakos,* pouch, and *leo,* lion).—Literally "pouched lion;" a carnivorous marsupial mammal from the pleistocene or uppermost tertiaries of Australia; and so called from the trenchant dentition of its skull (the only portion yet found), which rivals that of the lion in size.

Thylacothérium (Gr. *thylakos,* a pouch, and *therion,* animal).—A small marsupial mammal of the Oolite. Apparently the same as *Amphitherium,* which see.

Tile-Ore.—A variety of red oxide of copper, of a reddish-brown colour, occurring massive or incrusting, earthy or more or less indurated. It consists of sub-oxide of copper, mixed with much peroxide of iron and other substances.

Tilestone.—Any thinly-laminated sandstone suitable for roofing; applied specially to the flaggy beds at the base of the Old Red Sandstone. The

"Tilestones" as a group are regarded as the "passage or transition beds" between the Silurian and Devonian systems; and have been ranked by some geologists with the one system, and by others with the other. As developed in Hereford, Lanark, and Forfar, lithologically and palæontologically, we are inclined to consider them as the true basis of the Old Red Sandstone.

Tilgate Forest, in Sussex, situated on the clays, sandstones, and calciferous grits of the Wealden formation; a district rendered classical by the discoveries of the late Dr Mantell.—See his *Fossils of Tilgate Forest,* 1 vol. 4to, 1827.

Till.—A provincial Scotch term for the stiff unstratified clays of the Boulder formation.

Tilted up.—Applied to strata that are suddenly or abruptly thrown up at a high angle of inclination. *Tilts* of this nature are usually accompanied by fractures and crushings of the strata.

Tin (Lat. *stannum*). — A well-known metal of a silver-white colour, slightly tinged with grey, having a peculiar taste, and an odour which may be readily recognised when held for a while in the warm hand. It is considerably harder than lead; has a specific gravity of 7.3; and fuses at 442° Fahr.—a temperature 170° below the melting point of lead. It is very malleable when heated to about 200°, and is readily beaten into leaf or *tin-foil;* but it is not very ductile, though it may be drawn into wire of feeble tenacity. It is flexible, bending with a crackling noise, apparently the result of its crystallised structure—the fused metal crystallising in regular octahedrons. As a metal that does not readily tarnish, it is employed for coating sheet-iron (tin-plate), and copper; and its *foil,* alloyed with quicksilver, forms the reflecting surface of glass mirrors. It also unites with other metals and forms valuable alloys, as *bronze, bell-metal, speculum-metal,* and the like; and its salts, dissolved in muriatic acid, are used in dyeing and calico-printing. It has not been found native (or at least very doubtfully so), but it is obtained from *cassiterite,* pyramidal tin-ore or oxide of tin, which occurs in veins in the granitic and crystalline rocks of Cornwall, Saxony, Spain, the East India Islands, and other localities.

Tin Ore or **Tin Stone.**—The familiar name given to the oxide of tin, or *Cassiterite,* as being the only ore from which the tin of commerce is derived. It occurs in veins in the granitic and crystalline rocks, and is usually associated with wolfram, copper, iron-pyrites, and other minerals. It is found either in blackish-brown pyramidal or prismatic crystals; or massive in granular aggregates; and not unfrequently in rounded fragments in gravelly detritus. The name *wood-tin* is given in Cornwall to the kidney-shaped masses which have a finely fibrous or radiated structure; *toad's-eye-tin,* to the same variety when the concretions are small and berry-like; and *stream-tin,* to the gravel-like ore found with detritus in the gullies and water-courses of metalliferous districts. As an ore, it consists of 77.50 tin, 21.50 oxygen, with traces of iron and silica; and being disseminated through the veinstone, the rock must be pounded and washed before the ore can be smelted. As a geological generalisation, it is asserted that in Cornwall tin usually occurs in the upper portion of the veins, while copper is found below.

Tin-Pyrites.—Known also as *Stannine* or *Bell-metal ore;* a sulphuret of copper, tin, and iron, the iron sometimes replaced by zinc. It is a mineral of a steel-grey or sometimes of a coppery-yellow colour; occurring massive, granular, and disseminated, rarely crystallised; and is usually as-

sociated with tin-ore in the veins of Cornwall and Bohemia.—See STANNINE.

Tincal.—Crude borax, as it is imported from the East Indies in dirty-yellow crystals. When refined it constitutes the *Borax* of commerce, which see.

Tírolite (occurring in many parts of the Tyrol).—Known also as *Copper-froth;* a fine verdigris-green or azure-blue carbonate of copper and arsenic, occurring in reniform or mammillary aggregates, with a radiating foliated texture and drusy surface. It is found in beds and veins with other copper ores.

Titaníferous.—Containing or yielding titanic acid and titanium; as *titaniferous-cerite,* a blackish-brown mineral, consisting of the oxides of cerium, iron, manganese, and titanium; and *titan-schorl,* known also as *rutile* or *ingrine,* a mineral consisting of oxide of titanium and peroxide of iron.

Títanite. — Prismatic titanium ore; a silico-titanite of lime; better known to English mineralogists as SPHENE, which see.

Titánium (Gr. *titanos,* falling to a calx or lime).—One of the elementary substances, discovered by the Rev. Mr M'Gregor in 1789; it is of a dark copper-red colour, with a strong metallic lustre, which readily tarnishes on exposure to the air. As titanic acid, it is a constituent of several minerals, as *Menekite, Sphene, Brookite, Rutile,* and *Anatase.*

Toadstone.—A term applied by the Derbyshire miners to certain trap-rocks which occur interstratified, or in connection, with the mountain limestones of that country. Some of these toadstone beds are compact and basaltic, others are earthy, vesicular, and amygdaloidal. By some (and with every degree of probability) the term is said to be from the German *todt-stein* or dead-stone—the rock being dead or unfruitful of lead-ore as compared with the associated limestones; according to others, the rock obtains its name from the resemblance of its amygdaloidal spots to those on a toad's skin.

Topaz (Gr. *topazion,* though it is doubtful whether the topazion of the ancients were the same as our topaz).—One of the gems; occurring in finely striated prismatic crystals, massive with indistinct crystalline structure, or disseminated in rounded fragments; transparent, vitreous, electric when heated or rubbed, and of various colours or colourless. It is found chiefly in the granitic and crystalline rocks, and frequently associated with rock-crystal, tourmaline, beryl, and euclase, or with fluor-spar and other minerals containing fluorine. It is harder than quartz, has a specific gravity of about 3.5, and consists of alumina, silica, and fluoric acid. Topaz is highly valued as an ornamental stone, and the chief supplies are obtained from Brazil and Siberia, though found in many other countries. Those from Brazil have deep yellow tints, but become pale pink or red on exposure to heat; those from Siberia have a bluish tinge; the Saxon topazes are of a pale wine-yellow, but become limpid by exposure to heat; and those found in the Scotch Highlands are of a sky-blue colour. The purest from Brazil are termed *Goutte d'Eau* (drops of water), and, when cut in facets, closely resemble the diamond in lustre and brilliance. A common or coarse columnar topaz named *Pyrophysalite* is not to be confounded with the *Precious Topaz* above described.

Topázolite.—A pale yellow, nearly transparent, variety of garnet, found in Piedmont, and consisting of 37 silica, 2 alumina, 29 lime, 4 glucina, 25 iron, and 2 manganese.

Topaz-Rock.—The name given to a granular slaty mixture of quartz, schorl, and topaz, occurring at Schneckenstein, near Auerbach in Saxony.

Topógraphy (Gr. *topos*, a place, and *grapho*, I describe).—A particular account of any locality, city, town, or village; in contradistinction to the general *geography* of the country in which it is situated.

Tornádo (Span. *tournar*, to turn).—A whirlwind; any violent storm or hurricane of wind, usually accompanied with thunder, lightning, and rain. Tornadoes, though excessively violent and destructive, are for the most part limited in area and of short duration.

Tórrelite (after Dr Torrey).—A red-coloured variety of *Columbite* or *Niobite* from New Jersey, consisting of niobic acid, protoxide of iron, and manganese.

Torrid Zone (Lat. *torridus*, burning, scorching).—The middle zone or belt of the earth's surface, extending on each side the equator to the tropics of Cancer and Capricorn respectively; and so called from its high temperature.—See ZONE.

Tosca-Rock.—A name given by the inhabitants of Buenos-Ayres to a marly arenaceous rock found imbedded in layers and nodular masses among the argillaceous earth or mud of the Pampas. The term is used by Mr Darwin in his interesting descriptions, and has been adopted by subsequent observers.—See PAMPEAN FORMATION.

Touchstone.—A variety of *flinty slate*, so called from its being used for testing the purity of gold—the quality of the metal being judged of by the colour of the streak which it leaves on the stone.—See LYDIAN STONE.

Toúrmaline.—A mineral occurring in the granitic and metamorphic rocks of most countries, and so complex and variable in composition as to be usually divided into three groups—*Schorl*, *Achroite*, and *Rubellite*. It occurs in long prismatic crystals, generally striated vertically, and imbedded or attached. It is most frequently black, but is found of various colours, and occasionally colourless; is about the hardness of felspar; specific gravity 3.3; and becomes electrical by heat or by friction. Tourmaline is ranked under the "Gem" family, though not greatly prized as a precious stone—the red varieties being known as *Rubellites* or *Siberites* (from Siberia); the dark-blue as *Indicollites;* the black opaque varieties as *Schorl;* and the white or colourless as *Achroite.* "Though a wide-spread mineral, tourmaline," says J. Nicol, "is not of high geological importance, as it only forms an essential constituent of schorl-rock and topaz-rock, both very limited masses. It has hitherto been found only in the older plutonic and metamorphic rocks, and never either in the newer stratified or in the recent trap or volcanic formations. It is very common in granite, where it sometimes replaces the mica, and is frequently associated with quartz, orthoclase, albite, mica, lepidolite, chlorite, topaz, and beryl, either in druses or in subordinate beds, or with their crystals enclosed or intermixed with each other."

Toxóceras, Toxoceratite (Gr. *toxon*, a bow, and *keras*, horn).—A genus of the Ammonite family, peculiar to the Greensand or lower Chalk formation, and so named from the bow-shape of its shell—like an ammonite uncoiled. "Between *toxoceras*, *crioceras*, and *ancyloceras*," says Woodward, "there are numerous intermediate forms."

Tóxodon (Gr. *toxon*, a bow, and *odous*, tooth).—A large quadruped, of unknown affinity, from the upper tertiary or Pampean formation of South America, and so named by Professor Owen from the singularly

curved form of its two outer incisors. The skull is twenty-eight inches long and sixteen broad, and presents a blending of the osteological characters of several existing natural orders, as the Rodents, Pachyderms, and Cetacea.

Toxáster (Gr. *toxon,* bow, and *astron,* star).—A genus of fossil sea-urchins peculiar to the Neocomian or Lower Chalk formation, characterised by their somewhat semicircular contour (hence the name); by their undepressed ambulacra, which converge towards the summit of the case; by their horizontally-elongated pores; by the odd ambulacrum being in a deep groove; the mouth transverse, and the vent in the posterior face.

Tráchyte (Gr. *trachys,* rough).—The name given to the felspathic class of volcanic rocks which have a coarse cellular paste, rough and gritty to the touch. "This paste," says Lyell, "has commonly been supposed to consist chiefly of albite, but according to M. Delesse, it is variable in composition, its prevailing alkali being soda." Through the base are desseminated crystals of glassy felspar, mica, and sometimes quartz and hornblende, although in the trachyte properly so called there is no quartz. The varieties of felspar which occur in trachyte are tri-silicates, or those in which the silica is to the alumina as in the proportion of three atoms to one.

Trachýtic Porphyry.—This rock, according to Abich, has the ordinary composition of trachyte, with quartz superadded, and without any augite or titaniferous iron.

Transítion (Lat., going between, intermediate).—The passage from one state or period to another; hence we speak of the Tilestones as "transition beds" between the Silurian and Devonian systems; that is, partaking in some measure of the character of both systems.

Transition Rocks or **Strata.**—In the classification of Werner and his school the transition strata were separated from the primary as being less crystalline, affording unmistakable evidence of their mechanical or sedimentary origin, and containing occasional remains of plants and animals. For these reasons it was assumed they were deposited at a period when the earth and sea were passing into a state fit for the reception of organised beings; and hence the term *Transition.* It comprised the *Greywackè* formation of the older geologists; which has since been subdivided into the *Cambrian* and *Silurian* systems.

Translúcency (Lat. *trans,* through; *luceo,* I shine, from *lux,* light).—Literally "shining through;" that property of minerals and other substances which permits light to pass through them, but not in sufficient quantity to show distinctly the forms and colours of objects placed on their other side. A mineral is therefore said to be *translucent* when light evidently passes through its substance, though objects cannot be distinguished through it by the eye.—See TRANSPARENCY.

Transmutátion (Lat.)—A change from one place to another, or from one thing into another. A term adopted by Lamarck and his followers to express their hypothetical views of the derivation of existing species from preceding species, by slow and gradual *Transmutations* of one form of organisation into another form, independent of the interference of any creative agent, and merely by the influence of external or physical conditions, or by the internal impulses of the organism as affected by extraneous causes.

Transpárency (Lat. *trans,* through, and *pareo,* I appear).—Literally "appearing through;" that property of bodies which permits light to

pass through them so freely that the forms, hues, and distances of objects can be distinctly seen on the other side. Air, water, the purer kinds of glass, and many minerals, are therefore said to be *transparent;* and this property varies in intensity till it passes into mere *translucency;* and translucency also varies in degree till no light pass through, and the substance is said to be *opaque.*

Trap, Tráppean (Swedish, *trappa,* a stair).—Tabular greenstone and basaltic rocks, from their rising up in step-like masses, were originally so termed; but the name is now extended to all igneous rocks which are not either strictly *Granitic* or decidedly *Volcanic.* Others derive the origin of the term from the terrace-like aspect of secondary hills, generally composed of interstratified greenstones, basalts, amygdaloids, &c., which stand out in ledges from the softer strata that have yielded to denudation. Whatever the original idea, the term is now employed by geologists to embrace all the multifarious igneous rocks that belong to the palæozoic and secondary epochs, as distinct from the more ancient granites on the one hand, and the recent volcanic rocks on the other. The *Trappean* series thus embraces basalt, clinkstone, basaltic clinkstone, greenstone, greenstone-porphyry; compact felspar or felstone, felspar-porphyry; hornstone, pitchstone, pitchstone-porphyry; claystone, claystone-porphyry; amygdaloid, trap-tuff, wackè, trap-breccia, and the like. As a class, they are mainly composed of felspar, augite, and hornblende, the varieties differing according to the predominance of one or other of these ingredients.

Trass or **Tarass.**—A provincial German term for a Tertiary tufaceous alluvium or volcanic earth, which occupies wide areas in the Eifel district of the Rhine. Its basis consists almost entirely of pumice, in which are included fragments of basalts and other lavas, pieces of burnt shale, slate, sandstone, and numerous trunks and branches of trees. It seems to have originated either as a volcanic mud, like that thrown out by the craters of the Andes; or as volcanic dust and ashes deposited in the fresh-water lakes of the period. When pulverised it is used as an hydraulic cement, like the pozzolana of Italy.

Trávertin.—A whitish concretionary limestone deposited from the water of springs holding lime in solution; abundantly formed by the waters of the Anio, at Tibur, near Rome; hence the name Tiburtinus, Travertinus or Travertin. It is usually compact, hard, and semi-crystalline, and in this respect is distinguished from *Calc-tuff* or *tufa,* which is a loose and porous surface-deposit.

Trémadoc Slates.—A series of coloured slates and grits about 1000 feet thick, occurring at Tremadoc in North Wales, and constituting a portion of the Cambrian system of Sedgwick or the Lower Silurian of Sir Roderick Murchison.

Trémolite (named from Val Tremola).—A variety or sub-species of hornblende, known also as *grammatite* and *calamite,* of a white or greenish-grey colour, occurring in long prismatic crystals or in columnar aggregates—the crystals often bent and striated longitudinally, pearly and semi-transparent. Is found in dolomite, granular limestone, and other subordinate beds in the crystalline rocks.

Tretostérnon (Gr. *tretos,* perforated, and *sternon,* the breast-bone).—The generic term applied to the fossil bones of a turtle-like animal from the Wealden and Purbeck beds. It seems to be related to the river-turtles (*Trionyx* and *Emys*) of the hotter regions of Asia, Africa, and America.

Tri- (Gr. *treis,* Lat. *tres,* three).—A frequent prefix of scientific terms signifying thrice, or in threes; as *tri-partite,* divided into three parts; *tri-sected,* cut into three segments; *tri-lobate,* three-lobed; *tri-pinnate,* three times pinnate, &c.

Trias, Triássic System.—This system derives its name—*Trias* or triple series—from its being composed in Germany, where it is very fully developed, of three main members :—viz. the *Keuper,* the *Muschelkalk,* and the *Bunter-Sandstein.* These, as far as they can be compared, are lithologically and palæontologically the equivalents of the Upper New Red Sandstone of England, and may be intelligibly co-ordinated as follows :—

	Germany.	*England.*
1. KEUPER.	Saliferous and gypseous shales, with beds of variegated sandstones and carbonaceous laminated clays.	Saliferous and gypseous marls, with grey and whitish sandstones.
2. MUSCHELKALK.	Compact greyish limestone, with beds of dolomite, gypsum, and rock-salt.	(*Wanting.*)
3. BUNTER SANDSTEIN.	Various coloured sandstones, dolomites, and red clays; occasional pisolites.	Reddish sandstones and quartzose conglomerates.

Or extending the co-ordination to France, we have the following relations :—

England.	*Germany.*	*France.*
Variegated Marls.	Keuper.	Marnes irisées.
...	Muschelkalk.	Calcaire coquillier.
Variegated Sandstone.	Bunter Sandstein.	Grès bigarré.
...	...	Grès des Vosges.

The TRIAS is thus in all its relations the Upper New Red Sandstone of the earlier English geologists, and has been separated from the Lower New Red or PERMIAN, because its flora and fauna are essentially *Mesozoic,* and akin to those of the Oolite and Chalk, while those of the Permian are essentially *Palæozoic* in their facies, and related to those of the Carboniferous below.——In England the system is sparingly fossiliferous, but in Germany and France, as well as in Southern Africa and North America, where there is a large development of Red Sandstones, supposed to be of Triassic age, there is a fuller (though by no means exuberant) exhibition of Life, vegetable as well as animal. The Flora embraces equisetums, calamites, ferns, cycadaceous and coniferous plants; the Fauna corals, star-fishes, shell-fish, crustaceans, reptiles, numerous foot-prints of reptiles and birds, and indications of marsupial mammals.——Economically, the system is the great repository of rock-salt and brine-springs in England and Ireland.—See NEW RED SANDSTONE, and tabulations, "Geological Scheme."

Tricarpellítes (Gr. *treis,* three, and *karpos,* fruit).—Fossil nut-like fruits from the London clay, so called from their consisting of three carpels or seed-cells.

Trigonellítes (Gr. *treis,* three, and *gonê,* corner).—A shell-like organism consisting of two plates or valves, and so called from its triangular form. "The real nature of the shell," says Lyell, "of which there are many species in oolitic rocks, is still a matter of conjecture. Some are of opinion that the two plates formed the gizzard of a cephalopod; for the living

Nautilus has a gizzard with horny folds, and the Bulla is well known to possess one formed of calcareous plates."

Trigónia (Gr. *treis,* three, and *gonè,* corner).—A dimyarian bivalve of the Oolite and Chalk, so called from its three-cornered shape. The fossil trigoniæ are thick, tuberculated, ribbed shells—the ribs either radiating or arranged concentrically: but the shell having been almost entirely nacreous, it is generally wanting, and only the cast remains—the "horse-heads" of the Portland quarrymen. About 100 species are catalogued from the Trias to the Chalk inclusive; none have yet been found in Tertiary strata, but one or two species occur in the Australian seas.

Trigoniadæ.—A family of conchiferous molluscs, of which *Trigonia* is the type, having equivalve, close, three-cornered shells, with the umbones directed backwards; interior nacreous; ligament external; hinge-teeth few and diverging. The family is chiefly fossil, and includes *trigonia, myophoria, axinus,* and *lyrodesma.*

Trigonocárpon (Gr. *treis,* three; *gonè,* corner; and *carpos,* fruit).—A genus of thick-shelled fruits occurring in the coal-measures, and so called from the three projecting ribs or corners which mark the surface of the shell. They vary considerably in size, and are regarded as palm-nuts, to which they bear a striking resemblance.

Trílobite, Trilobitidæ (Gr. *treis,* three, and *lobos,* lobe).—An extensive family of palæozoic crustaceans, deriving their name from the obvious three-lobed-like aspect of their bodies. The trilobites in numerous generic forms, as *asaphus, ampyx, calymene, homalonotus, ilænus, ogygia, olenus, phacops, trinucleus,* &c., are especially characteristic of the Silurian system; about a dozen genera range through the Devonian epoch; only three or four make their appearance in Carboniferous strata; and not a single specimen has been found in any later formation. The skeleton of the trilobite consists of a cephalic shield or plate (*cephalo-thorax*), furnished with prominent many-facetted sessile (very rarely pedunculated) eyes on the upper or dorsal aspect, and beneath a labrum or "hypostome" which would indicate foot-jaws; a three-lobed body in segments less or more numerous; and a caudal plate or appendage (*pygidium*) variously terminated. As yet no indications of antennæ or limbs have been detected; "still," says Owen, "there can be no doubt they enjoyed such locomotive power as even the limpet and chiton exhibit when requisite." Many of them are extremely minute, and in all likelihood the larval forms of larger so-called genera; a considerable number attain a size of from one to six inches; and it is rarely indeed that fragments are found indicating species exceeding twelve or fifteen inches long. For the subdivisions of the group, and its place among the Crustacea, see tabulations, "Animal Scheme."

Trilóphodon (Gr. *treis,* three, and *lophos,* ridge).—Literally "three-ridged;" one of Dr Falconer's sub-genera of Mastodons, which are divided by him into *trilophodon* and *tetralophodon,* according as the crowns of their molar teeth exhibit *three* or *four* pap-like transverse ridges with intervening depressions.

Tríonyx (Gr. *treis,* three, and *onyx,* claw).—Literally "three-clawed;" a fossil tortoise or chelonian occurring in Tertiary strata; and doubtfully (from three-clawed imprints of footsteps) in any earlier formation.

Tríplite (Gr. *treis,* three).—A phosphate of manganese occurring in massive or coarsely granular aggregates, and so called from its being cleav-

able in three directions, at right angles to each other. Consists of 34 iron protoxide, 33 manganese protoxide, and 33 phosphoric acid.

Trípoli.—A polishing powder originally brought from Tripoli in Africa, but now found in many other places. It is a kind of "rotten-stone," composed of the siliceous shields of microscopic infusoria, and diatomaceæ; an infusorial or microphytal earth of a whitish-grey or yellow colour; soft, light, and friable.

Tristýchius (Gr. *treis*, three, and *stychos*, row).—A genus of cestraciont fin-spines or ichthyodorulites from the Carboniferous formation, indicative of shark-like fishes of great size; and so called from the triple row of barbs or tooth-like processes with which they are armed.

Trochítæ (Gr. *trochos*, a wheel).—A name given by the earlier palæontologists to the small detached joints of the encrinite.—See ENTROCHI.

Trochóceras (Gr. *trochos*, a hoop, and *keras*, horn).—A genus of nautilites found in the Upper Silurians of Bohemia. Shell nautiloid, spiral, depressed.

Trochus (Lat. *trochus*, a hoop).—An extensive genus of living and fossil univalves belonging to the family *Turbinidæ*, and characterised by their pyramidal-shaped numerous whorled shells, which are nearly flat at the base, and have an oblique rhombic aperture which is pearly inside; hence the common designation of "silver-shells." They are found fossil from the Devonian upwards, the fossil being more numerous than the existing species.

Trogonthérium (Gr. *trogo*, I gnaw, and *therion*, beast). — Literally "gnawing-beast;" an extinct rodent found in the fresh-water pleistocenes or uppermost tertiaries of Europe, and so closely allied to the existing beaver that it is by some palæontologists regarded as a mere specific or sub-generic form. Its bones indicate a size about a fourth larger than the largest known species.

Tróna (Arabic).—A crude carbonate of soda, occurring in crystalline incrustations in the deserts of Africa and Asia, and in the dried-up lakes and river-courses of South America. Consists of about 38 soda, 40 carbonic acid, and 22 water.

Tropics, Tropical (Gr. *tropikos*, from *trepo*, I turn).—Those two circles on the earth's surface over which the sun seems directly to pass when he is at the greatest distance from the equator—viz., 23½ degrees; hence the one is called the northern tropic or Tropic of Cancer, and the other the southern or Tropic of Capricorn. The zone or belt of the earth within these circles is said to be "within the tropics" or "*tropical*," and constitutes the Torrid Zone of climatologists. Plants, animals, climate, and other phenomena occurring within this region, are said to be *Tropical;* those on the extreme temperate verges of the region, *Sub-tropical.*

Trópifer (Gr. *tropis*, keel, and *fero*, I bear).—A minute crustacean from the Lias bone-bed of Aust Passage; so called from its keeled carapace.

Trough.—A familiar term for any sudden depression of strata by which they are made to assume the basin-shaped or synclinal arrangement. Generally used as synonymous with *basin* or *syncline.*

Tubiporítes (Lat. *tubus*, a tube, and *porus*, a pore).—Parkinson's term for a genus of fossil corals composed of closely-united calcareous tubes—each tube having been the abode of an individual polype. Now known as *Syringopora*, which see.

Tuff, Tufa (Ital. *tufo*, Gr. *tophos*).—Originally applied to a light porous

rock composed of cemented scoriæ and ashes; but now used for any porous vesicular compound, as *calc-tuff, trap-tuff, volcanic-tufa,* &c.; which see.

Tungsten (Swedish, *heavystone*).—A hard brittle metal, of a light steel-grey colour and brilliant metallic lustre, having a specific gravity of 17.5. It is barely fusible at the greatest heat of the smith's forge, but when heated to redness in the open air it is converted into the peroxide (tungstic acid). Its ores, tungstates of lime, iron, and manganese, are very frequently associated with those of tin, which they greatly injure. These are *wolfram,* tungstate of iron and manganese; *stolzite,* tungstate of lead; *scheelite,* tungstate of lime; and *tungstic ochre.* The metal is not used in the arts; but tungstic acid is employed in dyeing. It was discovered by Scheele in 1781; hence the occasional early synonym of *Scheelium* or *Scheelite.*

Tunicáta (Lat. *tunica,* a coat or tunic).—A class of headless molluscs, which have no shells, but are protected instead by an elastic, leathery-looking tunic; hence the name. The *tunicaries* have no organs of locomotion, but are found floating freely in the ocean, or fixed to rocks, shells, sea-weeds, and the like. They are hollow, and have two orifices from which they squirt the water after it has served the purposes of respiration and nutrition, and this forcible ejection assists in propelling those that are free floaters. They are divided into two great groups—the *fixed* or *Ascidians;* and the *free-floating* or *Salpians,* which see.

Turbináted (Lat. *turbo,* a whipping-top).—Top-shaped; generally applied to these univalve shells which, like the winkle and garden-snail, have a spiral top-like form.

Turbínidæ (Lat. *turbo,* a whipping-top).—An extensive family of gasteropod molluscs, of which the common *turbo* or "top-shell" has been taken as the type. The Turbinidæ (which include the genera *turbo, phasianella, trochus, euomphalus,* &c.) have spiral, top-shaped, or pyramidal shells; more or less pearly inside; and furnished with a calcareous or horny operculum. They are marine, littoral in their habits, feed on sea-weeds, and have a world-wide distribution.

Turbo (Lat. a whipping-top).—The common top-shell, a genus of gasteropod molluscs, embracing about 60 living species found in all seas; and upwards of 360 fossil species (including littorina) found from the Lower Silurian upwards.—See TURBINIDÆ.

Turin Nuts.—A familiar term for the fossil fruits of a species of Walnut, which occurs in the newer tertiary deposits in the neighbourhood of Turin. "The ligneous envelope," says Mantell, "has perished, but the form of its surface, and of the enclosed kernel, is preserved in calcareous spar."

Turkey-slate.—A familiar term for *whet-slate, novaculite,* or *honestone,* some of the best varieties being imported from Turkey, where it occurs of a remarkably fine and even grain, and of a greenish-grey or slightly yellowish colour.

Turquois.—The *uncleavable azure-spar* of Mohs, and the *Calaite* of other mineralogists; a phosphate of alumina with a little phosphate of iron and copper; occurring amorphous, reniform, stalactitic or incrusting; and usually of a beautiful sky-blue or greenish-blue colour. It takes a fine polish, and is highly prized as an ornamental stone. It is found in veins in flinty slate, but many of the finest Oriental turquoises are gathered as pebbles from the alluvium of Persia and Syria; and it is said that fossil teeth and bones coloured by hydrated copper oxide, or phosphate of iron

from Nuash in Siberia and Trevaux in France, are often substituted for the true mineral.

Túrrilite (Lat. *turris*, a tower, and *lithos*).—An extinct genus of chambered shells belonging to the Ammonite family, and characterised by their straight, spiral, turreted contour. They seem restricted to the Chalk formation, in which from twenty to thirty species have been detected.

Turtle Stones.—A familiar appellation for those nodular concretions commonly known as *Ludi Helmontii*, septaria, and the like.—See SEPTARIA.

Tympanóphora (Gr. *tympanon*, a cymbal, and *phoreo*, I bear).—A term applied to certain fossil plants, chiefly from the oolite, having minute branching stems, each branchlet being terminated by a rounded or globular appendage resembling a seed-vessel. Nothing is known of their nature, or of that of *Sphæreda*, which they somewhat resemble.

U

U'lmannite (after Ulmann).—An ore of nickel and antimony found chiefly in the copper-mines in the transition rocks of the Westerwald. It is of a bluish-grey colour, and consists of 26.8 nickel, 58.6 antimony, and 14.6 sulphur, but part of the antimony often replaced by arsenic.

Ulodéndron (Gr. *hule*, a wood, and *dendron*, tree).—A genus of coal-measure trunks, often of considerable size, and characterised by their stems not being furrowed, but covered with rhomboidal scales, and having on opposite sides two vertical rows of large circular scars, to which cones had been attached. In *Bothrodendron* (which see) the stem is dotted; and the cone-scars are obliquely oval.

Ultramaríne.—Literally "beyond the seas;" a well-known blue pigment of great permanence, and until lately prepared from the *lapis lazuli*—the finest specimens of which were brought from China and further Asia; hence the name. It is now artificially prepared by the chemist, cheaply and in any quantity, by uniting in proper proportions silica, alumina, soda, sulphur, and iron.

Umber (Lat. *umbra*, shade, hue).—A well-known pigment of various shades of brown; occurring either naturally in veins and beds, or prepared artificially from various admixtures. The "umber" proper of the mineralogist is a soft earthy combination of the peroxides of iron and manganese, with minor proportions of silica, alumina, and water. It is usually found in veins in the transition and crystalline strata, and appears to be a product of decomposition. Much of the umber of commerce, however, is a mere ochraceous admixture; and that from Cologne is said to be only brown-coal finely pulverised.

Umbo, plural **Umbones** (Lat.)—A boss or protuberance. In Conchology, that knob-like point of a bivalve shell which is situated immediately above the hinge.

Umbral (Lat.)—Shady, belonging to the dusk; the fourteenth of the fifteen series into which Professor H. D. Rogers subdivides the palæozoic

strata of the Appalachian Chain—the "Dusk" of the North American palæozoics, and the equivalent, in part, of our Carboniferous Limestone and Lower Coal-Measures.—See PALÆOZOIC FORMATIONS.

Unconformable.—Strata lying parallel on each other are said to be *conformable;* but when one set is laid on the upturned edges of another set, they are *unconformable.* Unconformability is generally taken as evidence of a break in geological sequence—the underlying set having been deposited, consolidated, and upturned, before the deposition of the unconformable or overlying strata.

U'nctuous (Lat. *unctus,* anointed, greasy).—Many minerals, such as steatite, talc, serpentine, and the like, when rubbed between the fingers, have an *unctuous* or greasy feel—a character which is often useful in discriminating species. Most of the magnesian minerals have this *feel,* which is altogether different from that produced by mere smoothness.

Underclay.—A term now generally applied to those argillaceous beds which immediately underlie seams of coal. These underclays are usually tenacious, more or less bituminous, and almost always interpenetrated by stigmaria roots. Every seam of coal has not an underclay; but where they exist they seem to have been the ancient soil or mud on which the vegetation of the coal-bed flourished.

Undercliff.—The term applied to a cliff when the upper part has fallen down along a considerable line of coast, and forms a subordinate terrace between the sea and the original shore.

Underlie or **Underlay.**—In Mining, the dip or inclination of a mineral vein viewed from above downwards.

Ungulite Grit.—A series of greenish-coloured shales and grits occurring near St Petersburg (probably of Lower Silurian age); and so termed because their prevailing shell is the *Obolus* or *Ungula,* a nail-shaped brachiopod of the Lingula family.

Uniónidæ (Gr. *unio,* a pearl).—The family of River-mussels, found in the ponds and streams of all parts of the world. They have a solid, pearly shell, with two principal and two lateral teeth on the hinge; and their umbones or bosses are generally smooth or longitudinally laminated. Those which have no cardinal teeth are arranged under the genus *Anodon.* Of the *Unio,* which is taken as the type of the family, there are about 250 living species; and about fifty species have been found fossil from the Carboniferous formations upwards. There is considerable doubt, however, whether the Carboniferous shells really belong to the genus *Unio;* some geologists refer them to *Cardinia,* and commence the Uniones with the Wealden.

Univalve (Lat. *unus,* one, and *valva,* a lid or valve).—Applied to molluscous animals or "shell-fish" whose shell consists of a single piece, as the periwinkle, limpet, &c.; in contradistinction to *bivalves,* like the cockle and mussel, whose shell consists of two valves or pieces.

Unstratified.—Applied to rocks which do not occur in layers or strata, but in amorphous masses; and as this is a feature of igneous rocks, the term is usually regarded as synonymous with *igneous.* Hence we speak of aqueous or *stratified* rocks, and of igneous or *unstratified* rocks; though, strictly speaking, many igneous products, as flows of lava and trap, showers of dust and ashes, &c., occur in stratiform or sheet-like accumulations.

Upheave, Upheaval.—A lifting up of strata by some expansive or ele-

vating power from below. The terms *upthrow* and *downthrow* are more generally used to designate such subterranean movements.

U'ranite.—Known also as *uran-mica, uran-glimmer,* and *lime-uranite;* a mineral occurring in flat tabular crystals of a sulphur-yellow to siskin-green colour, and consisting, according to Berzelius, of 15.5 phosphoric acid, 62.6 peroxide of uranium, 6.2 lime, and 15.7 water. It is found chiefly in granitic rocks, and occasionally in veins and beds in the crystalline strata with other ores. It is a calcareo-phosphate of uranium, and differs from *chalcolite,* which is a cupreo-phosphate, only in containing lime instead of copper.

Uránium.—A metal discovered by Klaproth in 1789, and so named by him after the planet Uranus, which was discovered in the same year. It is obtained from several mineral species, and is, when separated, a powdery substance of a greyish-black colour, with a metallic lustre, very combustible, and burning with a white light. It is separated with great difficulty; is infusible; and has a specific gravity of 9.0. Preparations of uranium are used for imparting fine orange tints to glass and porcelain enamel; and the uranite of potash affords a splendid orange to the artist. The various minerals containing uranium are in general easily distinguished by the hues of yellow they communicate to glass. The following are the principal:—1. *Uranium ore, pechurane,* or *pitchblende;* 2. *Uranite, uran-mica, uran-glimmer,* or lime-uranite; and, 3. *Chalcolite,* or copper-uranite.

Uran-Ochre or **Uranium Ochre.**—Earthy oxide of uranium, occurring in soft friable masses, disseminated or incrusting, along with pitchblende or protoxide of uranium, in the granites of Saxony and France. It has various hues of yellow and orange, and seems derived from the decomposition of the protoxide.

Urao.—A native term for the carbonate of soda found in crystalline crusts on the dried-up lakes and river-courses of South America; same as the *Trona* of the Arabs, which see.

U'rsidæ (Lat. *ursus,* a bear).—The Bear-tribe; a well-known family of carnivorous mammals, having a wide range both in the old and new worlds, and particularly in the northern hemisphere. The remains of several species (*U. spelæus, priscus,* &c.) have been found in the caves, breccias, and alluvia of the Pleistocene period.

V

Válentinite (after Valentine).—White oxide of antimony; a mineral occurring crystallised, or massive and disseminated in granular, columnar, and foliated aggregates; usually of a whitish-grey colour, and consisting of 84.32 antimony, and 15.68 oxygen.. It is found in veins in the primary rocks along with other ores of antimony, lead, and zinc.

Valley (Lat. *vallis*).—Any hollow or low-lying tract of land bounded by hill or mountain ranges; and usually traversed by a stream or river which

receives the drainage of the surrounding heights. We have thus "circular valleys," "longitudinal valleys," and "cross valleys," according to the configuration and disposition of the bounding heights; though, generally speaking, longitudinal valleys, taking their names from the rivers which flow through them, are the most characteristic and common. A level tract of great extent, and traversed by more rivers than one, is, properly speaking, not a valley, but a *plain;* and deep narrow river-courses, on the other hand, are, more correctly, designated *glens, ravines,* and *gorges.* Geologically speaking, valleys take their rise from original inequalities of the surface produced by subterranean movements; or they are the result of long-continued erosion by river-currents, and thence known as "Valleys of Erosion."—(See EROSION.) Occasionally we meet with such terms as "Valley of Elevation," and "Valley of Denudation"—the former being a huge fracture or rent produced by subterranean upheaval, and from which the strata dip away on either side—the latter being a mere valley of erosion scooped out by the action of water without disturbing the original position of the strata, which are continuous on both sides.

Vanádinite.—The vanadiate of lead, a rare mineral occurring in crusts of small hexagonal prisms, of a yellowish-brown colour and resinous lustre, chiefly along with other ores of lead, as at Wanlockhead, Matlock, Wicklow, and in auriferous veins in Siberia and Mexico. It consists, according to Thomson, of 66.3 oxide of lead, 7.06 lead, 23.44 vanadic acid, and 2.45 chlorine.

Vanádium.—A rare metal of a greyish-silvery colour, discovered by Sefstrœm in 1830, in the iron prepared from the iron-ore of Taberg in Sweden, and named after *Vanadis,* a Scandinavian deity. It has since been found in the form of vanadiate of lead or *vanadinite,* a mineral occurring in many localities. As a metal, the properties of vanadium are yet little known.

Variegated Sandstone.—The New Red Sandstone of English geologists; the *grès bigarré* of the French; and the *bunter sandstein* of the German. It is also termed by some the *Poikilitic* (variegated) System, in allusion to its mottled and particoloured shales and sandstones.

Variety (Lat. *varius,* changeable).—In Natural History, a subordinate division of a *species,* distinguished by some accidental or unimportant differences, not considered essential to the main and permanent characteristics of the species. Some slight difference in colour, in size, or in the greater or less development of some particular organ, may constitute a *variety,* while it may not affect the permanent characteristics of the species.

Variolite (Lat. *variolæ,* small spots).—The name given to those varieties of compact amygdaloid or amygdaloidal porphyry, in which the enclosed crystals are numerous, small, and round, giving to the rock a spotted appearance. This appearance is often rendered more striking from the matrix of the rock being of a different colour from the enclosed crystals.

Vascular (Lat. *vasculum,* a little vessel).—Composed of small vessels like the woody tissue or substance of flowering plants; and used in contradistinction to *cellular,* which denotes that the substance is built up of uniform cells, and consequently softer and less durable in structure. *Vascularity* indicates a higher degree of organisation than simple *cellularity.*

Vasodéntine (Lat. *vas,* a vessel, and *dens,* tooth).—An anatomical term employed to express that modification of *dentine* (see TEETH) in which

capillary tracts of the primitive vascular pulp remain uncalcified, and carry red blood into the substance of the tissue. They form the so-called vascular or medullary canals, and are usually more or less parallel in their course. A large proportion of the central part of the tooth of the sloth and megatherium consists of vaso-dentine, and a smaller proportion of the same part of the tusks of the elephant and of the chisel-like incisors of the rodents.

Vaúquelinite (after Vauquelin the chemist).—A chromate of lead and copper occurring in veins with other ores, in minute tabular crystals, or in mammillary crusts, of a dark olive-green colour and resinous lustre. Consists of 60.87 lead protoxide, 10.80 copper protoxide, and 28.33 chromic acid.

Vein (Lat. *vena*).—Applied in Geology to all fissures and rents in the earth's crust filled with mineral or metallic matter, differing from the rock-mass in which they occur — these subsequently filled fissures traversing and ramifying through the solid rock, like the *veins* through the living system. When such fissures are filled with granite, greenstone, claystone, or with other massive rock-matter, whether igneous or otherwise, they are all usually termed "dykes;" but when containing metalliferous ores or crystalline minerals, they receive the name of "veins or "lodes." The subject of veins is one of the most difficult and complicated — and interesting because difficult and complicated—within the whole range of Geology. It embraces the following questions or branches of research:—1. The nature of the substances occurring in mineral veins; 2. The mode or modes in which these substances were aggregated; 3. The situations of their occurrence, and the nature and age of the rock formations in which they occur; 4. Their frequency in any given district, and the directions they take—that is, whether they all trend in one way, or cross and intercross; 5. Their relative ages, so as to erect them into separate "Systems," and thus be enabled to apply such knowledge to their economical exploration. Such an inquiry involves, of course, much patient observation in Geology, an intimate acquaintance with Mineralogy, and, above all, a knowledge of those Chemical and Electrical forces which are continually acting, and must have similarly acted in all time past, in decomposing, dissolving, segregating, and reconstructing the mineral and metallic constituents of the earth's crust. For a brief and intelligible review of the theory of mineral and metallic veins, see Professor Phillips's "Manual of Geology" in *Encyclopedia Metropolitana*, together with the various authorities therein referred to.

Veined.—Streaked; marked, like some marbles, with lines or veins of colour, either parallel to, or crossing each other.

Veinstone.—The stony or mineral matter occupying a vein, in contradistinction to the metallic or metalliferous ores of which it forms the *matrix*.

Ventral (Lat. *venter*, the belly).—Of or belonging to the belly; *e.g.*, the *ventral* or belly-fins of fishes, as distinguished from the *dorsal* or back fins.

Véntricose (Lat. *venter*, the belly).—Bellying; swelling or bulging out in the middle; generally applied to hollow bellying forms.

Ventrículite (Lat. *ventriculus*, a ventricle or sac).—The name given to certain fossil zoophytes of the Chalk, usually appearing as fungiform flints, and well known to the inhabitants of Kent and Sussex as "petrified

mushrooms." Palæontologists are not agreed as to the precise nature of the ventriculites, which seem to have been of a spongiform flexible texture, and to have consisted of a hollow cup-like expansion, tapering to a point below, and attached by fibrous rootlets to other bodies.

Verd Antique (Ital. *verde antico*).—A clouded green marble, consisting of an admixture of serpentine and limestone, found at Genoa and in Tuscany, and much prized for its beauty.

Verde di Corsica Duro.—A rock found in the Island of Corsica, of a changing green colour, composed of Diallage and Labrador felspar, and used for vases, inlaying, and other ornamental purposes.

Vérdigris (Fr. *verde-gris,* green-grey).—A sub-acetate of copper, formed by bringing the surface of the metal in contact with acetic acid; and so called from its peculiar green colour. A rust of copper, or *Ærugo,* which see.

Vérditer.—A blue pigment, prepared by adding finely-levigated chalk or "whiting" to a solution of copper in aquafortis.

Vergent (Lat.)—Drawing to a close; the eleventh of the fifteen series into which Professor Rogers subdivides the palæozoic strata of the Appalachian Chain—the "Descending Day" of the North American palæozoics, and the equivalents of our middle Devonians.—See PALÆOZOIC FORMATIONS.

Vermículite (Lat. diminutive of *vermis,* a worm).—A mineral substance composed of minute micaceous plates disseminated through a mealy magnesian matrix, and having a soapy lustre and greasy feel. It consists of silica, magnesia, iron peroxide, alumina, and a trace of manganese. When heated to redness it swells out with a vermicular motion, as if it were a mass of small worms; hence the name.

Vermículítes (Lat. *vermis,* a worm).—Applied to the smaller and shorter worm-tracks which appear on the surfaces of many flaggy sandstones.

Vérmiform (Lat. *vermis,* a worm, and *forma,* shape). —Worm-like; worm-shaped. Vermiform casts and impressions occur in the sandstones of various formations; some apparently the true rejectamenta of annelids, like the earth- and lob-worm; others their tortuous tubes and burrows; and many their mere superficial tracks or trails.—See ARENICOLITES, FORALITES, SCOLITES, &c.

Vermílion.—A well-known brilliant red pigment, prepared by pulverising the red sulphuret of mercury, or *Cinnabar,* which see.

Vértebra (Lat. from *verto,* I turn).—A single bone of the backbone or spinal column. The different vertebræ comprising the backbone are usually divided into *cervical* or those of the neck, *dorsal* or those of the back, *lumbar* or those of the loins, and *caudal* or those prolonged into a tail in many classes of animals. Important distinctions are also founded upon the mode in which the several vertebræ are attached or jointed to each other—some being concave before (*procœlian*), others being concave at both ends (*amphicœlian*), and others flat in front and concave behind (*platycœlian*).

Vertebráta (Lat. *vertebra,* the joint of a backbone).—One of the two grand divisions of the Animal Kingdom, including all those animals furnished with *vertebræ* or backbones. In Cuvier's arrangement the *Vertebrata* embrace the Mammals, Birds, Reptiles, and Fishes; the *Invertebrata,* the Articulata, Mollusca, and Radiata.—See tabulations, "Animal Scheme."

Vesícular (Lat. *vesicula,* a little bladder).—Full of bladder-like cavities;

composed of cells or vesicles. Applied to rocks full of little cavities, as vesicular lava, vesicular trap-tuff, &c.—these cavities having arisen from the disengagement of gases when the rock-matter was in a molten state.

Véspertine (Lat.)—Of or belonging to the evening; the thirteenth of the fifteen series into which Professor H. D. Rogers subdivides the palæozoic strata of the Appalachian Chain—the "Evening" of the North American palæozoics, and the equivalents of our Lower Coal-measures or Carboniferous slates.—See PALÆOZOIC FORMATIONS.

Vesúvian.—A reddish-brown mineral of the Garnet family; so called from its being found in volcanic rocks, and in particular those of Vesuvius. Same as pyramidal garnet or *Idocrase,* which see.

Víbratile Organs (Lat. *vibro,* I move quickly or vibrate).—A common designation for those hair-like organs of motion with which so many of the lower aquatic animals are furnished; and termed CILIA, which see.

Vítreous (Lat. *vitrum,* glass).—Having the lustre or aspect of glass; glassy. *Vitrify,* to melt or convert into glass; *vitrified,* having the surface coated with, or partially converted into glass by the action of heat.

Vitrification (Lat. *vitrum,* glass, and *fio,* I become).—The conversion of any mineral substance into glass; hence we speak of "vitrified forts," of the "vitrification of rocks," &c.; when by the action of heat their surfaces are covered with a *glaze* or glassy coating, produced, as glass is, by the fusion of silica along with an alkaline flux.

Vitriol (Lat. *vitrum,* glass).—A term applied by the earlier chemists to all crystalline bodies having a certain degree of transparency, but now mainly restricted as a familiar designation for the following substances:—viz., *blue vitriol,* sulphate of copper or cyanose; *green vitriol,* sulphate of iron, copperas, or melanterite; *white vitriol,* sulphate of zinc or goslarite; *red vitriol,* sulphate of the proto-peroxide of iron and magnesia or botryogene; and *oil of vitriol,* or sulphuric acid, so called because originally distilled from green vitriol or copperas.

Vívianite.—A mineralogical term for *phosphate of iron,* which occurs in prismatic crystals, in fibrous reniform crusts, also massive, disseminated, and earthy; usually of a fine indigo blue; found in metalliferous veins, as well as a recent formation in connection with decomposed animal matter. It is sometimes used as a pigment.

Vivíparous (Lat. *vivus,* alive, and *pario,* I bring forth).—Animals, which bring forth their young alive and perfect, are said to be *viviparous,* in contradistinction to the *oviparous,* or those which produce their young in the egg.

Volcánic (*Vulcanus,* god of fire).—Igneous action apparent at the surface of the earth, in contradistinction to *Plutonic* (which see), or that taking place at great depths in the interior. *Volcanic,* as applied to rocks, embraces all igneous products of recent or modern origin, as distinct from Trappean and Granitic.—See IGNEOUS ROCKS.

Volcánic Bombs.—Bomb-like masses of lava, frequently occurring in great numbers in the vicinity of active volcanoes. Speaking of those on the island of Ascension, Mr Darwin remarks:—"They vary in size from that of an apple to that of a man's body; they are either spherical or pear-shaped, or with the hinder part (corresponding to the tail of a comet) irregular, studded with projecting points, and even concave. Their surfaces are rough, and fissured with branching cracks; their internal structure is either irregularly scoriaceous and compact, or it presents a symmetrical

and very curious appearance, which is very simply explained, *if we suppose a mass of viscid, scoriaceous matter, to be projected with a rapid, rotatory motion through the air.*"

Volcanic Foci (Lat. *focus*, a fire, the point of greatest intensity).—Subterranean centres of igneous action, from which minor exhibitions diverge.

Volkmánnia (after Volkmann).—A provisional genus of Coal-measure stems having verticillate or whorled leaves, and bearing cones on their extremities. They are regarded as *asterophyllites* in fructification.

Vóltzia (after Voltz of Strasburg). — A genus of coniferous plants peculiar to the Permian and Triassic formations. They greatly resemble *araucaria* in the form and imbrication of their leaves, which are inserted all round the pinnated branches, are sessile, slightly dilated at the base, and almost conical. Fruit in spikes or loose cones.

Vóltzine or **Voltzite** (after Voltz).—Oxysulphuret of zinc, occurring in small hemispherical incrustations, in quartz veins, and usually coloured brown or brownish-red by the presence of a small per-centage of iron peroxide.

Vóraulite.—An occasional synonym for the ferro-magnesian silicate of alumina, better known as *blue-spar, azurite* or *lazulite*—from its occurring at Vorau in Styria.—See LAZULITE.

Vúlcanism or **Vulcanicity** (Lat. *Vulcanus*, the god of fire).—A general term adopted by Humboldt, and made use of in his *Cosmos*, to embrace "the entirety of those telluric phenomena which are to be ascribed to the constantly active *reaction of the interior of the earth upon its external crust or surface.*" Thermal springs, gas and mud volcanoes, burning springs and salses, and the large burning mountains or volcanoes proper, are thus brought under one category; and he regards it "as advantageous to avoid the separation of that which is causally connected, and differs only in the strength of the manifestation of force and the complication of physical processes." The term has not yet been adopted by English geologists; and it must be confessed that there is considerable difficulty in associating phenomena which seem to depend on some deep-seated source of heat within the globe, with those that may arise from heat, chemically or otherwise generated, in the mere exterior or superficial crust.

Vúlcanists.—Applied to those Geologists who opposed the Wernerian or Neptunian doctrine, that all rocks were of aqueous origin, and who contended for the presence of igneous action in the formation and modification of the earth's crust.

Vulcanite.—An occasional synonym of *Pyroxene* or *Volcanic garnet*, from its occurrence in ejected blocks and lavas.

Vúlpinite.—A granular variety of anhydrous sulphate of lime or gypsum, so called from its being found at Vulpino in Italy, where it is polished for ornamental purposes, under the name of *marmo bardiglio.*

W

Wacké.—A German miner's term for a soft earthy variety of trap-rock, resembling indurated clay, but generally containing crystals peculiar to the Trap series. It is usually of a greyish-green colour, from the amount of earth it contains, is sometimes amygdaloidal, and readily crumbles down when exposed to the weather. It seems to be, in some instances, a compacted mass of volcanic dust and ashes; in others, an indurated volcanic mud.—See GRAU- or GREY-WACKE.

Wad or **Wadd.**—A miner's term for an earthy oxide of manganese, occurring in beds and incrusting veins and fissures in the older rocks. It is used chiefly as a coarse pigment in oil-painting; for colouring and glazing pottery; and in the manufacture of glass. When mixed with linseed oil, the ochrey variety often takes fire spontaneously.

Wágnerite (after Dr Wagner).—The fluophosphate of magnesia, a transparent mineral, having a vitreo-resinous lustre, wine-yellow or honey-yellow colour, and at one time confounded with the Brazilian topaz. It is very rare, and has been found only near Werfen in Salzburg, in quartz-veins in the Clay-slate formation.

Wálchia (after Walch).—A genus of coniferous plants occurring in the Carboniferous and Permian systems. According to Sternberg, who erected the genus, they have numerous closely-set, regularly-pinnated branches, resembling those of *Araucaria excelsa*, and which are thickly beset with foliage. In many instances the branches are terminated by oblong cones, composed of imbricated, oval, or lanceolate pointed scales.

Warp.—A provincial term for the muddy deposit from waters artificially introduced over low lands, as those adjoining the Trent, Ouse, &c. The process of *warping* consists in causing water loaded with silt to enter low flats at flood tides, there to remain till it has deposited its mud, and afterwards allowing it to run off clear when the tides are low. It is an important means of fertilising, as well as of raising the general level of large low tracts.

Waste.—In Mining, the old neglected workings of a coal-mine; so called from their being unattended to in ventilation, drainage, and other particulars.

Water.—In chemical nomenclature water is the *protoxide of hydrogen*, consisting of two volumes of hydrogen and one of oxygen, or of eight parts of oxygen to one of hydrogen by weight—88.9 oxygen, and 11.1 hydrogen. When pure and at ordinary temperatures, it is fluid and amorphous, without taste or smell, colourless in small quantities, but in large masses of a peculiar green or blue. The specific gravity of pure or distilled water, at 62° Fahr., is assumed at 1.000, and is taken as the standard of gravity for all other bodies; but sea-water varies according to locality, and the depth from which it is taken, from 1.027 to 1.029. When heated to the temperature of 212° Fahr., at the level of the sea and under the ordinary pressure of the atmosphere, water boils and is converted into steam; and this *boiling-point* (as it is termed) becomes less in proportion as we ascend

above the sea-level. At 40° Fahr. water is at its minimum volume, expanding as it rises above that temperature till it is wholly converted into vapour, and also, as it falls below it, till it is converted into *ice*—a transparent, brittle, crystalline solid. Water, as found on the earth, is never absolutely pure, but contains more or less of various substances, as atmospheric air, carbonic acid, nitrogen gas; silica, alumina, and salts (carbonates, sulphates, nitrates, phosphates) of lime, magnesia, soda, potash, protoxide of iron and manganese; or chlorides and fluorides of their metallic bases; and in the sea and some saline springs, also iodine and bromine. As a geological agent, water may be regarded in three main lights—viz., *vitally*, as indispensable to the life and growth of plants and animals; *chemically*, as entering less or more into the composition of all inorganic or mineral bodies; and *mechanically*, as abrading, transporting, and reassorting the materials of the earth's crust, by its operations in rain, rivers, waves, tides, and other currents.

Water of Crystallisation.—Many substances, in passing from a state of solution to the solid crystalline form, combine chemically with a certain portion of the water; which in a dry state forms an essential part of their crystals, and seems, in some cases, to give the peculiar determination to their constituent molecules; the amount of this water is the "water of crystallisation."

Water-shed.—In Physical Geography, the ideal line which separates two river-basins or systems of natural drainage—all the springs and streamlets "shedding-off," like the roof of a house, as it were, to their respective basins. The water-shed is not necessarily a mountain-chain, and in some rare instances it is broken by a water-communication connecting two great river-systems.

Water-worn.—Worn away, smoothed and rounded by the action of water, as the "shingle" in the bed of a river, or the "pebbles" on the sea-shore. *Water-worn* blocks are generally smooth and rounded in form; *weather-worn*, rough, and more or less honeycombed.

Wávellite (after Dr Wavel, its discoverer).—Phosphate of alumina; a transparent yellowish-grey or greenish-grey mineral, occurring in minute acicular crystals, which unite in hemispherical masses, with a radiated fibrous texture and drusy surface. It is found in various formations, but chiefly in clay-slate and other older rocks; and is sometimes confounded with *Hydrargillite*, which is a pure hydrate of alumina.

Wayboards.—A mining term, now pretty generally employed by geologists to designate any thin layers or bands that separate or define the boundaries of thicker strata; thus we speak of thick beds of limestone separated by "wayboards" of slaty shale, of sandstones separated by "wayboards" of clay—these thin layers indicating the lines of junction at which the strata separate or give way.

Weald (Sax. *wold*, a woodland).—The low country lying between the North and South Downs of Kent and Sussex; and from this locality being the chief area in Britain of a formation that lies between the Oolite and the Chalk, the term *Wealden* or *Weald* has been applied to the strata of that formation.—See Wealden Group.

Wealden Group.—In the tabulations of English geologists, that series of strata which occurs between the uppermost beds of the Oolite and the lower ones of the Chalk formation. By some it is regarded as a fresh-water or estuarine group of the oolitic system; by others it is classed as the lowest

member of the cretaceous system ; but as a subordinate "group," lithologically and palæontologically, it is sufficiently distinct from either. Dr Mantell, to whom we are indebted for the most detailed account of the Wealden, describes it as "a series of clays and sands with subordinate beds of limestone and shale, containing fresh-water shells, terrestrial plants, and the teeth and bones of reptiles and fishes ; univalve shells prevailing in the upper, bivalves in the lower, and saurian remains in the intermediate beds ; the state in which the organic remains occur manifesting that they have been subject to the action of river-currents, but not to attrition from the waves of the ocean." As a group, the Wealden is of limited extent in England and on the continent of Europe, while in other regions its precise equivalents have not yet been detected. As typically developed in Kent and Sussex, it seems to occupy the site of an ancient estuary, which received the clay and mud of some gigantic river, whose waters occasionally bore down the spoils of land plants and land animals, to be entombed along with those of aquatic origin. Regarding it as the upper group of the oolitic system, it may be said to consist of two main members—the Weald Clay and Hastings Sands, which, when analysed, exhibit the following particulars, taken in descending order:—

Weald Clay.—Thick blue clays, having in the upper part septaria of argillaceous ironstone, and in the lower parts beds of the shelly fresh-water limestone (*paludina limestone*), known as "Sussex, Petworth, or Bethersden marble."

Hastings Sands.—Fawn-coloured sand and friable sandstone (Horsham beds) ; calciferous sandstones, alternating with friable and conglomerate grits (Tilgate beds) ; white sand and friable sandstone alternating with clay (Worth Sandstone) ; bluish limestone alternating with blue clay and sandstone shale, and some beds of calciferous sandstone (Ashburnham beds).—See tabulations, "Geological Scheme."

Weathering.—The wasting or wearing away of rock-surfaces by exposure to the atmosphere or weather. Geologists speak of the "fresh fracture" in contradistinction to the "weathered surface," which is often merely discoloured or covered by a pellicle of lichens.

Weather-worn.—Applied to rocks and cliffs whose faces are less or more wasted and worn away by the action of the water. Many rocks being of unequal hardness, their weather-worn surfaces present very fantastic shapes, and are often deeply pitted and honeycombed.

Websterite (after Dr Webster).—Hydrous subsulphate of alumina ; known also as *Aluminite*, a snow-white or yellowish-white earthy mineral, occurring in soft reniform masses, with a very fine scaly or fibrous structure. It seems to arise from the decomposition of clays in recent formations, and consists of 30.26 alumina, 23.37 sulphuric acid, and 46.37 water.

Wenlock Limestone and **Shale.**—A characteristic group or section of the upper silurian strata, typically developed near Wenlock, in Shropshire. Near Wenlock the *limestone* (formerly well known to collectors as the "Dudley Limestone") consists of thick masses of grey sub-crystalline strata, replete with corals and encrinites. It is essentially of a concretionary nature, the concretions being locally known as "bell-stones," and consisting of pure carbonate of lime. The *shale*, which is a mass of fine argillaceous matter, imbedding numerous calcareous concretions, is by far the largest member of the group, ranging from 600 to 1000 feet in thickness, and replete with corals, encrinites, trilobites, shells, and other marine

exuviæ. Near Coalbrookdale the shale is known as "die-earth," because it lies beneath all the mining ground—the minerals "dying out," as it were, at this stage of descent.—See SILURIAN SYSTEM.

Wérnerite (after Werner).—A rare mineral, occurring in long prismatic crystals, translucent, colourless, pale-grey or greenish-yellow; and found chiefly in veins in the crystalline rocks. Chemical and crystallographic constitution somewhat uncertain, but now regarded as a variety of SCAPOLITE, which see.

Wetheréllia (after Mr Wetherell).—One of Mr Bowerbank's genera of fossil fruits from the London clay. They seem to have been pulpy fruits divided into two lobes by the expansion of the ripe seeds; and from the appearance which their section presents, are popularly known as "petrified coffee berries."

Whet-stone.—Known also as "Whet-slate" and "Novaculite;" a very hard, fine-grained siliceous slate, used for sharpening knives, joiners' tools, and other instruments.—See HONE.

Whim.—In Mining, a machine consisting of a winding barrel or cylinder, usually worked by horse or water power, and used for raising ore, coal, or other stuff from a mine.

Whin, Whinstone.—Used in Scotland as synonymous with greenstone; but applied by miners and quarrymen to any hard resisting rock that comes in the way of their operations.

Whirl or **Whorl.**—In Conchology, a wreath or single turn of the spire of a univalve shell, such as the *helix* or garden snail. The axis of revolution is termed the *columella*, and the turns of the spiral are denominated *whirls* or *whorls*. In some shells the whirls are few, in others they are numerous and distinct; in some they are arranged in a long, tapering, screw-like spiral; in others they form a short, pointed cone; while in many they are coiled round each other on a horizontal plane in wheel-like or discoid form. In most univalves, when the aperture is turned towards the spectator, and the apex upwards, the whirls run from left to right to the apex: in a few this order is reversed; hence we speak of *reversed* or *sinistral* shells.

Whitby Snakes.—A provincial, and now obsolete, term for the coiled-up, snake-like shells of the ammonite, found abundantly in the Lias of Whitby, in Yorkshire.

Whitestone.—A variety of felspathic granite; the *Weiss-stein* of Werner; and the *Eurite* of French mineralogists.—See EURITE.

Wichtisite or **Wichtyne.**—One of the Garnet family, nearly allied to *Glaucophane* (which see); and so called from its being found at Wichtis in Finland.

Williamite (after Prof. Williams).—A siliceous oxide of zinc, nearly related to *Galmei* or electric *calamine*, and usually found along with it.—See ZINC.

Wissenbach Slates.—A series of slaty schists, impure limestones, and quartzose beds which lie at the base of the Devonian System as developed in the country along the Rhine.

Wíthamite (after Dr Witham).—A variety of epidote, found in porphyry in Glencoe, and occurring in minute bright-red crystals.—See EPIDOTE.

Witherite (in honour of Dr Withering, its discoverer).—Carbonate of barytes; known also as *barolite*, and found abundantly in veins traversing the older formations.—See BARYTES.

Wóhlerite (in honour of Wöhler the chemist).—A translucent, vitreous,

yellowish-brown mineral occurring in tabular crystals, or in strongly striated six- or eight-sided prisms in the zircon-syenite, near Fredericksvärn and Brevig in Norway; and containing, according to Scheerer, 30.62 silica, 14.47 niobic acid, 15.17 zirconia, 26.19 lime, 7.78 soda, and the protoxides of iron and manganese.

Wolchite.—The *prismatoidal copper glance* of Phillips; a mixed ore of copper, lead, antimony, arsenic, and sulphur, occurring in the iron mines of Wölch, in Carinthia.

Wolchonskoite or **Volchonskoite.**—A variety of chrome-ochre occurring as an emerald-green or blackish-green massive mineral, and containing from 20 to 35 per cent of chrome-oxide.

Wolfram (Ger. *wolf*, wolf, and *rahm*, froth).—The name given by Werner to the Tungstate of iron and manganese, a mineral occurring in short prismatic crystals, or in granular froth-like aggregates of a blackish-brown colour, metallic adamantine lustre, and having a specific gravity of from 7. to 7.5, and a hardness about 6. It occurs, for the most part, associated with ores of tin in the primary and transition rocks, and occasionally in such abundance as to render the tin-ore worthless. According to Berzelius, it consists of 74.67 tungstic acid, 18. protoxide of iron, and 6. manganese, with a trace of silica.

Wolfsbergite.—Antimonial copper; a double sulphuret of copper and antimony, found crystallised, massive, or granular, in quartz at Wolfsberg, in the Harz Mountains.

Wóllastonite (after Wollaston the chemist).—The *tabular spar* of Phillips; a silicate of lime, with traces of magnesia and iron, occurring chiefly in granular limestone, but also in the trap and volcanic rocks. It is ranked as one of the Hornblende family, but is rarely crystallised—occurring mostly in broad prismatic or tabular masses, of a greyish-yellow or reddish-brown colour, having a vitreous or pearly lustre. Specific gravity 2.8; hardness 4.5.

Wood-Coal.—A synonym for *Lignite* or *Brown-coal*, in allusion to its woody texture, which is often as distinct and well-preserved as the texture of recent timber.—See LIGNITE.

Wood-Opal.—A variety of opal, known also as *lithoxylon* or opalised wood, in which the form and texture of the wood is still distinctly visible. Beautiful specimens are obtained from Hungary, and from near Hobart Town in Van Diemen's Land.

Woodstone.—A familiar term for silicified wood, such as that from Antigua, the Desert of Cairo, and Van Diemen's Land.

Wood-Tin.—Fibrous oxide of tin; a variety of tin-ore so called from its fibrous texture resembling that of wood. It is usually of a brown or yellowish-grey colour, and occurs in rounded fragments, having an internal fibro-radiating texture. It is found in Cornwall, Mexico, and other tin-yielding countries; and consists, according to Vauquelin, of 91 oxide of tin, and 9 peroxide of iron.—See TIN.

Woolwich-beds.—A name occasionally employed by English geologists to designate those beds of plastic and mottled clays, sands, and rolled flint-pebbles which lie between the "Thanet Sands" and the "London Clay." Next to the Thanet Sands they form the lowest beds of the London Tertiary Basin.

Wrae Limestone.—A limestone of the lower silurian series, occurring at Wrae-hill, near Innerleithen in Peeblesshire.

Wulfeníte.—A mineralogical term for the molybdate of lead; a mineral of a wax- or orange-yellow, occurring in short prismatic or pyramidal crystals collected in druses, and found in beds and veins in secondary and transition limestones. Consists of 60 protoxide of lead, and 40 molybdic acid.

Wych or **Wich.**—A Celtic word signifying *salt spring;* hence the termination of such English towns as Droitwich, Nantwich, Middlewich, &c., where salt springs exist.

X

Xanthídium (Gr. *xanthos,* yellow).—A genus of Diatoms, whose microscopic case or frustule consists of a hollow, siliceous globe, beset with spines; and whose endochrome or colouring matter, in recent species, is of a deep yellowish-green; whence the name. They abound in recent, tertiary, and upper secondary formations; and from their increase by self-division, usually appear as twin spherules.

Xánthíte (Gr. *xanthos,* yellow).—A mineral of the Garnet family, occurring in small, greenish-yellow, translucent, loosely-connected grains, in a bed of limestone near Amity in New York. It seems, from its composition, to be a variety of *idocrase,* which is found in the same locality.

Xánthokon.—A sulpho-arsenite of silver occurring in rhombohedric crystals, or in small reniform masses; and so called from its orange-yellow or yellowish-brown colour. It consists of 63.4 silver, 14.7 arsenic, and 21.9 sulphur.

Xanthophýllite (Gr. *xanthos,* yellow; *phyllon,* leaf; and *lithos*).—The rhombohedric pearl-mica of Mohs, occurring in mica and talc schists, and so named from its yellowish colour and foliated texture.

Xiphosúra (Gr. *xiphos,* a sword, and *oura,* a tail).—Literally "sword-tail;" a division of the entomostracous crustaceans, in which the last segment of the body forms (in the adult animal) a long, three-edged, sharp-pointed weapon, as in the limulus, or king-crab. The *xiphosura* differ from other crustaceans in having the basal joint of their thoracic feet furnished with spines which serve as masticatory organs (foot-jaws); in having their branchiæ or gills composed of membranous folds attached to the basal portion of the abdominal legs; in having the head and breast united into one buckler-like plate (the cephalo-thorax); and in having the abdominal buckler terminating in the long sharp-pointed spine which gives them their name. The thoracic feet, which generally terminate in pincer-like claws, are used for prehension and mastication; the abdominal, which are foliaceous or leaf-like, subserve the purposes of swimming and respiration. The existing species are all marine, and inhabitants of warmer regions; the fossil species range from the Upper Silurian and Lower Old Red, and appear to have been of much more gigantic dimensions than their living congeners.

Xýlite (Gr. *xylon,* wood).—A mineralogical term for those varieties of amianthus which have a woody-like texture; and better known, perhaps, as "mountain-wood," "rock-wood," &c. They consist essentially of silica, magnesia, and iron protoxide.

Xylóretine (Gr. *xylon*, wood, and *retinē*, resin).—Literally "wood-resin;" a sub-fossil resinous substance occurring in connection with the pine-trunks of certain peat-mosses, and evidently the slightly-altered resins of these trees.

Y

Yánolite.—The name given by Lametheric to the *Thummerstein* of Werner, and the *Axinite* of Haüy. One of the Garnet family, consisting of silica, alumina, lime, iron, and manganese.

Yellow Earth.—A massive earthy mineral of the Clay family, of an ochre-yellow colour, somewhat greasy feel, adheres to the tongue, and pulverises in water. It seems to be a mixture of hydrous silicate of alumina, with hydrous peroxide of iron; and is perhaps a decomposed clay-ironstone. When burnt and prepared it is sold by the Dutch as a pigment under the name of "English Red."

Yénite.—A double silicate of lime and iron, occurring in crystalline strata, along with quartz, magnetic ironstone, copper pyrites, and other ores; and known also as *Lievrite* or *Ilvaite*. It was named *Yenite* in commemoration of the battle of Jena, in 1806; *Ilvaite*, from Elba, where it occurs; and *Lievrite*, after its discoverer, Le Lievre.

Yoredale Rocks.—The name given by English geologists to the upper group of the Carboniferous Limestone, as developed in the north-western parts of Yorkshire—the *Scar Limestone* forming the lower group. The Yoredale Rocks consist of several beds of limestone alternating with freestones, flagstones, shales, and thin seams of coal, and attain a thickness of about 1000 feet.

You-stone.—A familiar term for Chinese *Jade*, or *Nephrite*, which see.

Y'ttria.—The name given by Ekeberg to a new earth discovered by Gadolin, in 1794, in the quarry of Ytterby in Sweden; hence the name. It has also been called *Gadolinite* (which see), after its original discoverer.

Y'ttria-spar.—According to Hartmann, this occurs as a white incrustation, as Gadolinite, and other minerals from Ytterby in Sweden.

Yttrium.—The metallic basis of the earth *Yttria*. When separated from the silica, lime, iron, and manganese with which it is associated in Yttria, it appears as a fine white powder, tasteless, inodorous, infusible, and insoluble in water.

Yttro-cérite.—A rather rare mineral substance occurring in granular incrustations of a violet-blue to a whitish-grey colour; and consisting, according to Berzelius, of about 47 lime, 18 peroxide of cerium, 10 yttria, and 25 hydro-fluoric acid.

Yttro-colúmbite.—The name given by Brochant and Dana to yttrious oxide of columbium; *Yttro-tantalite*, which see.

Yttro-ílmenite.—Same as *Lamarskite*, which see.

Yttro-tantalite. — Yttrious oxide of tantalum; a mineral occurring in kidney-shaped masses, of a shining metallic lustre, at Ytterby in Sweden. Berzelius distinguishes the black, brown, and yellow varieties; which consist of somewhat varying proportions of tantalic and tungstic acids, yttria, lime, and peroxides of uranium and iron.

Yttro-titanite.—Known also as *Keilhauite;* a blackish-brown translucent mineral, having a resinous fracture, and much resembling garnet, but distinguished by its greater specific gravity. It is a silicate of lime, iron, and alumina, with titanic acid and yttria; and occurs in the granitic and crystalline rocks of Norway.

Z

Zaffre.—In Mineralogy, the impure oxide of cobalt, being the residuum of the native arseniuret of cobalt, after the arsenic, sulphur, and other volatile matters have been expelled by calcination. Melted with silica and potash, and reduced to powder, it becomes the "powder-blue" of commerce.

Zamióstrobus.—The generic term applied to fossil cone-like fruits, apparently those of plants allied to the zamia and cycas. They occur chiefly in the Upper Oolite, Wealden, and Chalk formations.

Zamítes.—The general term for all fossil plants apparently allied to the existing zamia. They make their appearance in the upper oolites, and continue throughout the secondary and tertiary formations. The existing zamias (see order *Cycadaceæ*) being natives of the tropical parts of Asia and America, and of the Cape of Good Hope and Australia, their occurrence in ancient formations gives evidence of tropical or sub-tropical conditions of climate in the areas of deposit.

Zeágonite (Gr. *zeo*, I swell or bubble up, and *gonè*, an angle).—A mineral of the Zeolite family, and so named from its tetragonal crystals, which are chiefly arranged in spheres or bundles. Known also as *Gismondine* and *Abrazite;* but not very decidedly separable from the lime or potash *harmotomes* or cross-stones, to which it is often referred.

Zechstein (Ger.)—Literally "mine-stone;" because it has to be mined or cut through to reach the copper-slate (*Kupfer-schiefer*) which lies immediately beneath it. Von Buch suggests that the word was probably derived from the Italian *zecchino* or sequin, formerly a well-known coin in Germany, because this calcareous rock was the cover which, being pierced, led to the bed of ore from which the miner derived his profit. The German "Zechstein"—upper and lower—is the equivalent of the permian or magnesian limestone of England.—See PERMIAN SYSTEM.

Zenith (Arabic).—In Astronomy, that point in the heavens which is vertically or right above the head of the spectator; the term *nadir* being that which denotes the opposite point, or that perpendicularly or right under his feet. In popular language, the term *Zenith* is used to denote the highest or culminating point of any subject referred to; as the "zenith of the poet's fame," the "zenith of saurian development."

Zéolite (Gr. *zeo*, I boil or bubble up, and *lithos*, stone).—An extensive family of minerals—silicates of lime and alumina—so called from their frothing or intumescing into a whitish spongy enamel under the blowpipe. The family includes hexahedral zeolite or *analcime*, prismatic or *natrolite* and *mesotype*, prismatoidal or *stilbite*, hemiprismatic or *Heulandite*, pyramidal or *apophyllite*, rhomboidal or *chabasite*, diprismatic or *laumonite*, paratomous or *harmatome*, &c., all of which are noticed under their respec-

tive names. The zeolites occur most abundantly in the amygdaloidal trap-rocks; frequently in basalt and greenstone; occasionally in the granitic and crystalline rocks; and more rarely in the trachytes and lavas.

Zéro.—A word of Arabic origin signifying emptiness or extreme deprivation, and usually represented by a cipher or 0. It is variously used in science; but may be generally defined *as the neutral point between any ascending and descending scale or series.* In familiar language it is used as synonymous with nothing, or the extreme point of depression. The *zero* of Fahrenheit's thermometric scale is 32° below freezing; the real or *absolute zero* would be the point at which caloric was entirely exhausted.

Zeúglodon (Gr. *zeugos,* a yoke, and *odous,* tooth).—Literally "yoke-tooth;" a tertiary mammal of the whale kind, so called by Professor Owen from the peculiar form of its molar teeth. Remains of a skeleton between seventy and eighty feet in length were first discovered in the eocene strata of Alabama and Arkansas, and described by Dr Harlan under the title BASILOSAURUS (*king of the lizards*), under the supposition that they belonged to an enormous reptile—a belief that has since been set aside by the more correct investigations of our great English anatomist.

Zeúxite (Gr. *zeuxis,* connection or union, because found in the *united mines,* Cornwall).—A mineral of the Scapolite family, occurring in fibrous masses of acicular crystals of a greenish-brown colour, and evidently allied to *Prehnite.* Chemically, it is a ferro-silicate of alumina.

Zíanite.—Werner's synonym for kyanite or cyanite, one of the Garnet family, which see.

Zinc (Ger. *zink*).—One of the simple or elementary bodies; a metal of a bluish-white colour, with a fine granular fracture, foliated structure, specific gravity about 7, harder than lead, but may easily be cut with a knife. At common temperatures it is tough and intractable under the hammer; but when heated to between 220° and 320° it becomes malleable and ductile, so that it can be beaten into plates, or rolled into sheets and leaves, and drawn into wire. If heated, however, to 500° or so, it becomes brittle, and fuses at 770°. It tarnishes on exposure to the air, but is little oxidated, the first-formed film of oxide long resisting the action of air and water, and thus preventing further decay. Being a cheap and light metal, zinc is largely used as a substitute for lead; alloyed with copper, it forms the well-known compound *brass;* and its salts are extensively used in medicine and the arts. As a metal Zinc does not occur native; and its chief ores are—*calamine,* or the carbonate, occurring most abundantly in limestones along with calc-spar, ores of lead and iron, and other ores of zinc; *blende,* or the sulphuret, found also in veins with other ores; *Goslarite,* or the sulphate, arising apparently from the decomposition of blende; *zincite,* or the red oxide; and *galmei* or the siliceous oxide, usually found in connection with calamine. The ores of zinc are readily determined by first roasting and then fusing by the blowpipe on charcoal with copper filings. If zinc is present the copper will be converted into a button of brass.

Zíncite.—The mineralogical term for the native ferriferous oxide of *zinc,* which see.

Zínckenite, properly **Zinkenite.**—A native sulphuret of antimony and lead (35. lead, 43.4 antimony, and 21.6 sulphur), occurring in narrow vertically-striated prisms, or in massive and columnar aggregates in veins, along with sulphuret of antimony and quartz at Wolfsberg, &c., in the Harz, and so named after its discoverer, Zinken.

Zircon.—One of the gems; a heavy, hard, sparkling mineral, more or less transparent; doubly refractive; and occurring colourless, or of various colours, as yellow, green, and reddish-brown. It is found in prismatic crystals, or in rounded grains, chiefly in the granitic and crystalline rocks; and consists, according to Berzelius, of 33 silica and 67 zirconia. The colourless varieties named *jargon* are often sold for diamonds; the brilliantly-coloured are termed *hyacinth,* though many "hyacinths" are merely garnets, and easily detected by their inferior gravity, hardness, fusibility, and want of double refraction.

Zircónia.—The oxide of zirconium; a white tasteless earth, discovered by Klaproth in 1789, in zircons from Ceylon—zircon being a silicate of zirconia more or less highly coloured by oxide of iron.

Zircónium.—The metallic basis of zirconia, obtained in the form of a black powder, resembling that of charcoal, but lustrous when rubbed.

Zoanthária (Gr. *zoon,* animal, and *anthos,* flower).—Animal-flowers; in de Blainville's arrangement, the third class of zoophytes, including the hydras, coral-polypes, sea-anemones, and the like, whose bodies or digestive sacs are furnished with tentacula, which radiate from the mouth like the petals of a flower.

Zóisite.—A variety or sub-species of epidote, or prismatoidal augite spar, of a yellowish or light-grey colour, occurring in granite, diorite, and other crystalline rocks, and named after its discoverer, Baron Von Zois.

Zoólogy (Gr. *zoon,* an animal, and *logos,* discourse).—The science of living beings in all that relates to their structure, habits, distribution, and classification. *Zoological,* appertaining to the science of animal life; *zoologist,* one devoted to the study of Zoology, or the knowledge of animal forms in all their relations—structural, functional, and gradational. For systematic arrangements, see tabulations, "Animal Scheme."

Zone, in Geography (Gr. *zona,* a girdle).—One of the five great belts into which the earth is supposed to be divided in respect to temperature; viz. the *torrid,* two *temperate,* and two *frigid* zones. The torrid includes all the space that lies between the tropics, or 23½ degrees on each side of the equinoctial line; the temperate from that limit to the Arctic circle (66½ degrees) in each hemisphere; and the frigid zones from the Arctic circles to either pole.

Zone, in Botany.—With a view to generalise their observations on the geographical distribution of indigenous plants, Botanists are in the habit of dividing the horizontal range of vegetation into *zones,* bounded by annual isothermal lines, as—1, the equatorial; 2, tropical; 3, sub-tropical; 4, warmer temperate; 5, cooler temperate; 6, sub-arctic; 7, arctic; and 8, the polar. These zones, being applicable to either hemisphere, express the climatic facies of vegetation within more precise limits than the three great zones—torrid, temperate and frigid—of the geographer.

Zone, in Zoology.—Every zone, from the shore daily covered by the tides to the greatest vital depths, being characterised by its own peculiar seaweeds and shell-fish, in a manner very analogous to the changes in the forms and species of vegetation observed in the ascent of a tropical mountain, Zoologists are in the habit of speaking of certain bathymetrical zones or "zones of life regulated by depth." Thus, in the British seas, naturalists (following the late Edward Forbes) point out *four* great belts of life—the *Littoral,* the *Laminarian,* the *Coralline,* and the *Coral* (which see); or applying the principle to the life of the ocean in general, they

distinguish *five* belts of depth—viz. 1, the Littoral; 2, Circum-littoral; 3, Median; 4, Infra-median; and, 5, the Abyssal or Deep-sea zone. "The life-forms of these zones," says Professor Owen, "vary, of course, according to the nature of the sea-bottom; and are modified by those primitive or creative laws that have caused representative species in distant localities under like physical conditions—species related by analogy. Very much (he continues) remains to be observed and studied by naturalists in different parts of the globe, under the guidance of the generalisations thus sketched out, to the completion of a perfect theory; but in the progress to this the results cannot fail to be practically most useful. A shell or a sea-weed, whose relations to depth are thus understood, may afford important information or warning to the navigator. To the geologist, the distribution of marine life according to the zones of depth has given the clue to the determination of the depth of the seas in which certain formations have been deposited."

Zoónomy (Gr. *zoon*, an animal, and *nomos*, law).—The science which treats of the laws of organic life, in as far as these relate to the *Animal* kingdom.

Zoóphagous (Gr. *zoon*, an animal, and *phago*, I eat).—Animal-eating; applied to certain tribes of animals (*e.g.* "zoophagous molluscs") which prey on other animals: in contradistinction to those that are *phytophagous* or vegetable-feeders.

Zóophyte (Gr. *zoon*, animal, and *phyton*, plant).—Animal-plants; an early and popular division of the animal kingdom, including the sponges, corals, and other allied aquatic creatures, which, from their manner of growth and appearance, were supposed to be intermediate between plants and animals. Being wanting in scientific precision, the term is only loosely and popularly applied to those polypes, polyzoa, &c., which secrete plant-like substances, as sponges, corals, corallines, and so forth.

Zoophytólogy (Gr. *zoophyton*, a zoophyte, and *logos*, discourse).—That department of Natural History which treats of the structure, mode of growth, habits, and distribution of zoophytes.

Zosterítes.—A genus of fluviatile plants occurring in the Wealden and Lower Greensand formations, and so called from their resemblance to the existing *zostera marina* or sea-wrack. In *zosterites* the leaves are linear, marked with few veins, and these not connected by transverse veins.

Zúndererz (Ger.)—Tinder-ore; an ore of antimony occurring in the Saxon mines in soft, flexible, tinder-like masses, of a blackish-red colour and little lustre. From analysis it appears to be an admixture of silver, lead, iron, antimony, arsenic, and sulphur.

Zwiéselite.—A fluo-phosphate of iron and manganese, so called from being found at Zwiesel, in Bavaria.

Zygomatúrus.—A large marsupial mammal—the most extraordinary yet discovered in the post-tertiary deposits of Australia, and so named from the great width of the zygomatic arches of the skull. Judging from the size of the head, which was the only portion found in 1858, it seems to have been as large as an ox, and to have had a face somewhat resembling that of the existing wombat. It also appears to make a near approach to, though differing generally from, the *Diprotodon*, another large marsupial from the same ancient alluvial beds.

III.

SPECIFIC APPELLATIONS

NOTE.

THE following List contains the greater portion of those terms employed by palæontologists to distinguish their so-called *species* of fossil plants and animals. Most of them are Latin, or Latinised forms, and refer chiefly to external aspect; not unfrequently to the name of the discoverer, or other individual eminent in the branch of natural history to which the object belongs; and in many instances to the locality where it was first detected, or in which it is exclusively found. Thus, *Pecten quinquecostatus,* the five-ribbed pecten; *P. Woodwardii,* after S. P. Woodward, the eminent conchologist; and *P. Purbeckensis,* a species apparently peculiar to the Purbeck beds of the Oolite. Whatever their origin (and it is greatly to be desired that describers would in every instance endeavour to adopt such terms as refer to some palpable characteristic), these designations follow the usual inflexion of Latin words—*rotundus, rotunda, rotundum—pulcher, pulchra, pulchrum,* or *brevis, brevis, breve* being respectively applied just as the generic word to which they refer may be masculine, feminine, or neuter; while the names of discoverers, &c. are thrown into the possessive case, as *Lyellii, Murchisoni;* and those of localities converted into adjectives, as *Hibernicus, Purbeckensis,* and the like, but this, it must be confessed, not always in the most classical or most euphonious forms. Our present business, however, is more with their meanings than with their origin, and these we have endeavoured to render in the simplest and briefest language, consistent with the comprehension of the fact or character which the original term was intended to express.

SPECIFIC APPELLATIONS.

A

A'ælensis, is, e; found at Aalen in Wirtemberg.
abbreviátus, a, um; shortened.
abdúctus, a, um; removed.
abĭes; the fir-tree; fir-tree like.
abjéctus, a, um; worthless.
abnórmis, is, e; out of the usual order; abnormal.
abrúptus, a, um; abrupt; terminating suddenly.
acáulis, is, e; stalkless; stemless.
accipénseroïdes; sturgeon-like; resembling the sturgeon.
acerósus, a, um; of the maple-tree; resembling the maple.
acetábulum; slightly concave, like a cup or calyx.
aciculátus, a, um; needle-pointed; furnished with sharp points.
acinacifórmis, is, e; scimitar-shaped.
actinúra; star-tailed; prickly-tailed.
aculeátus, a um; prickly; armed with sharp points.
acuminátus, a, um; pointed; terminating sharply.
acutángulus, a, um; acute-angled; sharp-cornered.
acútifolius, a, um; sharp-leafed; having pointed leaves.
acutiróstris, is, e; sharp-nosed; sharp-beaked.
acutiúsculus, a, um; rather sharp; somewhat acute.
adolphĭnus, a, um; brotherly; in brotherhoods; closely related.
aduncátus, a, um; hooked; formed like a hook.
adúncus, a, um; crooked; shaped like a hook or claw.
ægagrápiloïdes; shaggy; like the wild goat's hair.
æquilaterális, is, e; equal-sided; having equal sides.
æquiseptátus, a, um; equally divided by septa or partitions.
æquisulcátus, a, um; equal-furrowed; having furrows of equal size.
æquivalvis, is, e; equal-valved; valves of the same size.
áffinis, is, e; adjoining; contiguous.
agaricifórmis, is, e; shaped like a mushroom.
agaricoïdes; mushroom-like.
Agassizi; in honour of Agassiz, the distinguished naturalist.
agglutinâns; glued to, or joined to one another.
agréstis, is, e; belonging to the fields; field-dwelling.
alátus, a, um; winged; having wing-like appendages.
albo-gálĕrus; white-hat; white-helmet shape.

alifórmis, is, e ; wing-shaped ; in the form of wings.
Allani ; after Mr Allan, of Edinburgh, mineralogist.
Alnwicensis, is, e ; found at Alnwick in Northumberland.
alpêstris, is, e ; Alpine ; growing at great elevations.
altĕrnans ; alternating ; following one after another one.
alternátus, a, um ; alternating ; following at intervals.
alutáceus, a, um ; tanned ; like tanned leather.
alveoláris, is, e ; hollowed like a trough or channel.
ambĭguus, a, um ; ambiguous ; doubtful.
ammonoĭdes ; ammonite-like ; curved like a ram's horn.
amphĭbius, a, um ; amphibious ; living on land or in water.
amphŏra ; a flagon ; flagon-shaped.
ampliátus, a, um ; enlarged ; spread out.
amplus, a, um ; full ; full-sized.
ampúlla ; a flask or flagon ; flask-shaped.
ampulláceus, a, um ; bottle-shaped ; flagon-like.
ampullósus, a, um ; puffed out ; flagon-like.
amygdalæformis, is, e ; almond-shaped.
amygdaloĭdes ; almond-like ; in the form of almonds.
anástomósus, a, um ; anastomosing ; running one into another like the veins of a leaf.
ănătīnus, a, um ; duck-like.
ancĕps ; doubtful ; undetermined.
ancȳloĭdes ; shield-like ; formed like a shield.
Andersóni ; after the Rev. Dr Anderson of Newburgh, Fife.
angeioĭdes ; vessel-like ; flagon-shaped.
Anglĭcus, a, um ; English ; found in England.
anguílla ; an eel ; eel-like in form.
angustátus, a, um ; narrowed ; constricted.
angústidens ; narrow-toothed ; compressed tooth.
angustifolius, a, um ; narrow-leaved.
angústifrons ; narrow-fronted ; having a narrow forehead.
annéctens ; connecting ; approaching ; akin to.
Anningiæ ; after Miss Anning of Lewes, collector of fossils.
annulátus, a, um ; annular ; ring-shaped ; ringed.
anómalus, a, um ; anomalous ; irregular.
anomolopóra ; having unusual pores.
anserínus, a, um ; goose-like ; of or pertaining to the goose.
Anstedi ; after Professor Ansted of London, geologist.
anthracínus, a, um ; coaly ; found in or belonging to coal.
antíguus, a, um ; ancient ; of early date.
aperturátus, a, um ; full of apertures ; fissured.
apicális, is, e ; sharp-pointed ; tapering to a slender point.
apicicurvátus, a, um ; curved at the top or apex.
apiculátus, a, um ; pointletted ; slender-pointed.
approximátus, a, um ; approximating ; close upon one another.
aquĭla ; an eagle.
aráchnoĭdes ; cobweb-like ; cobwebby.
aráchnoĭdeus, a, um ; in the form of a cobweb.

aráneus, a, um; spider-web like ; lightly netted.
arboréscens ; arborescent ; branching like a tree.
archetýpa ; original ; the original type.
arcígerens ; arch or bow bearing ; bow-shaped.
arctos ; belonging to the arctic regions ; northern.
arcuárius, a, um ; arched ; bent like a bow.
arcuátus, a, um ; bent ; arched ; bow-shaped.
arculátus, a, um ; coffer-like.
arenárius, a, um ; sandy ; belonging to the sand.
arenícolus, a, um ; sand-dwelling ; burrowing in the sand.
areolátus, a, um ; areolate ; divided into a number of irregular squares or small angular spaces.
argútus, a, um ; clear ; decided ; pretty.
armátus, a, um ; armed ; furnished with defences.
arthríticus, a, um ; jointed ; furnished with joints.
articulátus, a, um ; articulated ; closely-jointed.
articulósus, a, um ; jointed ; full of joints.
arvénsis, is, e ; field-inhabiting ; belonging to the fields.
asper, a, um ; rough ; rough-surfaced.
aspergillifórmis, is, e ; brush-shaped.
aspergíllus ; a brush for sprinkling holy water.
aspérrimus, a, um ; extremely rough ; harsh with points.
aspérulus, a, um ; roughish ; somewhat rough.
astacoïdes ; lobster-like ; cray-fish-like.
asthenodéirus ; weak-necked ; slender-necked.
astroïdes ; star-like ; rayed like a star.
astróphorus, a, um ; star-bearing ; starred.
auloporoïdes ; pipe-pore like ; resembling the aulopore coral.
aulóticon ; pipe-shaped ; pipe-like.
aurántium ; an orange ; like an orange.
auricula ; an ear ; like an ear.
auriculáris, is, e ; ear-shaped.
auriculátus, a, um ; eared ; having ear-like appendages.
aurítus, a, um ; long-eared ; decidedly eared.
Austĕni ; after Mr Godwin Austen, geologist.
avellána ; filbert ; like a filbert.
avenifórmis, is, e ; oat-pipe-shaped ; like an oaten straw.
avículoïdes ; bird-shaped ; in the form of a little bird.
axinæfórmis, is, e ; axe-shaped ; axe-like.

B

baccátus, a, um ; berried ; furnished with berry-like excrescences.
bacilláris, is, e ; staff-like ; straight like a staff.
bacíllum ; a staff ; staff-like.
baculiformis, is, e ; staff-like ; staff-shaped.
balteátus, a, um ; belted.
Bálticus, a, um ; from the Baltic shores ; belonging to the Baltic sea.

barbátus, a, um; bearded.
Bechei; after Sir Henry de la Beche, geologist.
Becklesii; after Mr Beckles, geologist and palæontologist.
béllulus, a, um; pretty; neat.
béllus, a, um; beautiful; elegant.
Beudantii; after M. Beudant, French geologist.
bicalcarátus, a, um; two-spurred; armed with two spurs.
bicarinátus, a, um; having two keels or ridges.
bicordátus, a, um; in the form of two hearts; twin-hearted.
bicoróna; double-crowned; twin-crowned.
bicostális, is, e; having two ribs, or rib-like processes.
bídens; having two teeth; bidentate.
bidorsátus, a, um; having a double back.
bifasciátus, a, um; doubly banded; two-striped.
bífrons; doubly fronted; two-fronted.
bifurcátus, a, um; bifurcated; branching in two; forked.
bilineátus, a, um; two-lined; marked with two lines.
bílobus, a, um; two-lobed; bilobed.
Bínneyi; after Mr Binney of Manchester, geologist.
bínus, a, um; double; in pairs; twinned.
bioculátus, a, um; double-eyed; twin-eyed.
bipartítus, a, um; bipartite; divided into two; two-cleft.
bíplex; double; two-fold.
bipunctátus, a, um; doubly punctured.
bispinósus, a, um; doubly spined.
bisuffarcianátus, a um; doubly stuffed; swollen.
Blumenbáchii; in honour of Blumenbach, naturalist.
Bollensis, is, e; found at Boll in Wirtemberg.
bóops; ox-eyed; large- or full-eyed.
boreális, is, e; boreal; belonging to northern latitudes.
botulifórmis, is, e; sausage-shaped.
bovínus, a, um; ox-like; allied to the ox family.
Bowerbanki; after Dr Bowerbank of London, microscopist.
brachycéphalus, a, um; short-headed.
brachydéirus; short-necked.
brachypygópterus, a, um; short sub-dorsal finned.
brachyúrus, a, um; short-tailed.
bréviceps; short-headed.
brevicóllis, is, e; short-necked; closely attached.
breviróstris, is, e; short-nosed; short-beaked.
brevis, is, e; short.
brevispínus, a, um; short-spined.
Briáreus, a, um; many-armed, like the fabled Briareus.
Broderipii; in honour of Mr Broderip, geologist.
Brodiei; after Mr Brodie, author of *Fossil Insects.*
Brongniarti; after Brongniart, the French fossil botanist.
Brownii, Browniana; after R. Brown, the celebrated botanist.
bucárdium; ox-heart; shaped like an ox-heart.

buccinéus, a, um; trumpet-like.
buccinoïdea; like the shell buccinum.
Bucklandi; after Dr Buckland the geologist.
bullátus, a, um; bossed; round like a nail-head; studded with small round knobs.
bulloïdes; shaped like the shell *bulla.*
búrsa; a purse; purse- or pouch-shaped.
byssáceus, a, um; having a "byssus," or appendage of fine filaments, like flocks of wool.

C

cœlátus, a, um; carved in relief; sculptured.
cæspitósus, a, um; turf-like; turfy.
calcarátus, a, um; spurred; spur-shaped; furnished with spurs.
calcarifórmis, is, e; spur-shaped; in the form of a spur.
calcéola; sandal; like a sandal.
calopóra; beautiful-pored.
cálvus, a, um; bald; smoothly bare.
calyculáris, is, e; cup-like; like the calyx of a flower.
calȳculus, a, um; like a little cup; calyx-like.
campanulátus, a, um; bell-shaped.
campȳlodon; curved or crooked tooth.
canaliculátus, a, um; channeled; grooved.
canalíferus, a, um; furnished with channels or canals.
cancellária; latticed; furnished with cross-bars.
cancellátus, a, um; latticed; cancellated.
cancriformis, is, e; crab-formed; crab-like.
cándidus, a, um; white.
cannœfórmis, is, e; cane-shaped; having a cane-like stem.
canteriátus, a, um; railed; staked.
caperátus, a, um; shrivelled; puckered in wrinkles.
capilláceus, a, um; hairy; covered with fine hairs.
capilláris, is, e; hair-like; capillary; in tubes like hairs.
capistrátus, a, um; haltered; muzzled.
capitátus, a, um; headed; furnished with small heads.
cáprĕŏlus; the roe-buck; roebuck-like.
carbonáceus, a, um; carbonaceous; found in the coal-measures.
carbonárius, a, um; of or belonging to the coal-measures.
cardioïdes; cardium- or cockle-like.
carinária; having a keel or ridge.
carinátus, a, um; keeled; furnished with ridges more or less elevated.
carinélla; a little keel or ridge.
carpomórpha; fruit-shaped; in the form of a fruit.
caryophȳllus, a, um; clove-like; clove-leaved.
cassínoïdes; helmet-like.
cássis; a helmet.
castáneus, a, um; chestnut-like.

catenátus; a, um; chained or connected together.
caténifer, a, um; chain-bearing; linked like a chain.
catenulátus, a, um; chained; formed of little links.
cathedrális, is, e; spire-like; tapering and spire-like.
catíllus; a little dish.
cátus; the cat; cat-like.
caudális, is, e; tailed; having a prominent tail.
caudátus, a, um; tail-pointed; furnished with a tail.
caulinæfólia; stalk-leaved.
cavátus, a, um; hollowed out; hollow.
cavĭfrons; hollow-fronted.
celluláris, is, e; cell-like; cellular; full of cells.
centrális, is, e; central; in the middle.
centrótus, a, um; knotted; having prominent tubercles.
cepæfórmis, is, e; onion-shaped; like an onion.
cervicórnis, is, e; shaped like a stag's horn.
cervínus, a, um; deer-like; allied to the deer-kind.
chamæformis, is, e; cockle-shaped.
charæfórmis, is, e; like the fresh-water plant *chara.*
Charleswórthii; after Mr Charlesworth of London, naturalist.
cínctus, a, um; girdled; encircled with lines.
cinéreus, a, um; ash-coloured; ashy.
cingulátus, a, um; girdled; encircled with lines.
circinátus, a, um; compassed; encircled; whorled.
circumvéstens; surrounding some other object.
circumsulcátus, a, um; furrowed all round.
cirrhósus, a, um; cirrhous; terminated by a curled filiform appendage.
cirroïdes; cirrus-like; having a curled appendage.
citharélla; little lute.
clathratulus, a, um; slightly latticed; slightly cross-barred.
clathrátus, a, um; cross-barred; latticed.
clathroïdea; bar-like; lattice-like.
clava; a knotty branch; knob-like.
clavaroïdes; club-like.
clavátula; little club.
clavátus, a, um; club-like; club-shaped.
claviculáris, is, e; collar-bone-shaped; clavicle-like.
cláviger, a, um; club-bearing.
clisioïdes; chamber-like; separated into small chambers.
cluniculáris, is, e; haunch-like.
clypeátus, a, um; shield-like; furnished with a shield.
cochlearélla; little screw; spiral-shaped.
cochleátus, a, um; screw-shaped; spiral.
Cólei; after Lord Cole, now Earl of Enniskillen, palæontologist.
colubrínus, a, um; snake-like.
columbélla; a little dove.
columelláris, is, e; little pillar-like.
combústus, a, um; burnt up; parched; withered-like.
commúnis, is, e; common; of frequent occurrence.

comósus, a, um ; bushy; shaggy like hair.
complanátus, a, um ; smoothed; smooth-surfaced.
compléxus, a, um ; complex; in many folds; not simple.
compressiróstris ; flattened beak; pressed together.
comptus, a, um ; elegant; adorned.
concávus, a, um ; hollow; depressed; concave.
concéntricus, a, um ; arranged in concentric lines.
conchiticus, a, um ; shelly; shelly in aspect.
concinnus, a, um ; handsome; pretty; neat.
cónfluens ; confluent; running together; running into one.
conĭcus, a, um ; conical; tapering to a point.
conĭfer, a, um ; cone-bearing; bearing cones like a fir-tree.
conjúngens ; immediately joining; approximating.
conoïdea ; cone-like.
consobrínus, a, um ; a cousin; nearly allied.
constrictus, a, um ; bound closely together; constricted.
contiguus, a, um ; near; close to.
contortidens ; twisted tooth; twist-tooth.
contórtuplicátus, a, um ; folded and much twisted.
contórtus, a, um ; twisted.
contractus, a, um ; contracted; drawn together.
conŭlus ; a little cone.
convéxus, a, um ; convex; bent round.
convolútus, a, um ; convoluted; rolled as it were together.
Conybearii ; after the Rev. Dr Conybeare, English geologist.
coralloïdes ; coral-like; having the aspect or structure of coral.
corbŭla ; a little basket.
cordátus, a, um ; heart-like; heart-shaped.
cordifórmis, is, e ; heart-shaped.
cornĕus, a, um ; horny; having a texture like horn.
corniculátus, a, um ; horned; furnished with horn-like processes.
cornu ; a horn; horn-like in form.
cornu-ariétis ; ram's horn; curled like a ram's horn.
Cornúbicus, a, um ; of, or belonging to, Cornwall.
cornu-bōvis ; ox-horn; ox-horn-like.
cornu pastoris ; shepherd's horn.
cornútus, a, um ; horned; having horn-like appendages.
corolláris, is, e ; corolla-shaped; blossom-like.
coróna ; a crown.
corónŭla ; little crown.
corrugátus, a, um ; corrugated; much wrinkled.
corticátus, a, um ; having a coat of bark; coated.
corŭlum ; darling; term of endearment.
corymbósus, a, um ; ivy-berried; in clusters.
coryphænoïdes ; diadem-like.
costátus, a, um ; ribbed; having prominent ridges.
costelátus, a, um ; having very faint ribs.
costulátus, a, um ; having little ribs.
Cotteswoldiæ ; from the Cotteswold Hills, Gloucestershire.

crassatínus, a, um ; thickish.
crassicáuda ; thick tail.
crassicaúlis, is, e ; thick-stalked or stemmed.
crassicónus, a, um ; thick-coned ; bluntly-tapering.
crássidens ; thick-tooth ; thick-toothed.
crassinérvus, a, um ; thick-nerved ; fleshy-nerved.
crassirostris, is, e ; thick-beaked.
crassispínus, a, um ; thick-spined ; strong-spined.
crassíssimus, a, um ; very thick ; the thickest.
crassiúsculus, a, um ; thickish ; somewhat thick.
crassivénter ; thick-bellied.
crássus, a, um ; thick ; stout.
craterifórmis, is, e ; goblet-shaped.
crenáto-striátus, a, um ; convex-striated ; marked with convex lines.
crenátula ; having small convex teeth.
crenátus, a, um ; having convex teeth ; crenulated.
crenuláris, is, e ; marked like the lines of a battlement.
crenulátus, a, um ; slightly crenulated ; zigzagged.
crepídŭla ; a slipper ; slipper-like.
cretáceus, a, um ; chalky ; belonging to the chalk formation.
cribrósus, a, um ; sieve-like ; full of openings.
críspus, a, um ; curled.
crista-gálli ; cock's comb.
cristátus, a, um ; crested ; peaked.
cristélla ; little crest.
cruentátus, a, um ; bloody.
cruména ; a purse.
crustuléntus, a, um ; thin-crusted ; wafer-like.
cryptopóra ; hidden-pored ; having the pores concealed.
cubícodon ; solid tooth ; cubical teeth.
cuculláea ; hood ; hood-like.
cucullátus, a, um ; hooded ; furnished with a hood.
cúltridens ; knife-tooth ; knife- or sharp-toothed.
Cummingæ ; after Lady Gordon-Cumming of Altyre, Morayshire.
cuneátus, a, um ; wedged ; wedge-shaped.
cuneiceps ; wedge-headed.
cuneiformis, is, e ; tapering in the form of a wedge.
cunículus ; the rabbit ; cony-like.
cupressifórmis, is, e ; cypress-shaped ; like the cypress tree.
cupuliformis, is, e ; cup-shaped, like an acorn.
curtansátus, a, um ; shortened ; curtailed.
curteócerus, a, um ; short-horned.
curtus, a, um ; short.
curvicórnis, is, e ; bent-horned.
curvidens ; bent-toothed ; having the teeth bent inwards.
curvinódus, a, um ; bent at the joints.
curviróstris, is, e ; bent-beak ; bent-jaw.
cuspidátus, a, um ; pointed like a spear.
Cuvieri ; in honour of Cuvier, the celebrated French naturalist.

cyathifórmis, is, e; cup-shaped; goblet-shaped.
cyclostóma; circular-mouthed; circle-mouth.
cyclus; a circle; round or circular-shaped.
cy̆gnĭpes; swan-footed; like the swan's foot.
cylindrícŏdon; cylindrical tooth.
cylíndricus, a, um; cylindrical, cylinder-shaped.
cymbifórmis, is, e; boat-shaped; like a skiff.
cy̆mbium; a skiff or boat.
cy̆mbŭla; a little skiff.
cyphus, a, um; crooked; humped; convex.

D

Dædáleus, a, um; beautifully worked as if by Dædalus.
dama; the fallow-deer; fallow-deer-like.
damæcórnis, is, e; deer's-horn-like.
decadáctylus, a, um; ten-fingered; ten-rayed.
decipiens; deceptive; doubtful.
declívis, is, e; sloping; bending downwards.
decorátus, a, um; decorated; ornamented with figure-work.
decúrrens; running down along; extending.
decussátus, a, um; arranged in pairs that alternately cross each other.
definĭtus, a, um; definite; determined.
defóssus, a, um; deeply buried; sunken.
Delabêchii; after Sir Henry Delabeche, geologist.
delicátulus, a, um; rather delicate; slender.
deltoïdea; shaped like the Greek letter Δ, delta; trowel-formed.
denárius; a coin; in form of a coin.
dendrínus, a, um; tree-like; branching like a tree.
dendrophylloïdes; tree-leaf-like; reticulated like the leaf of a tree.
dentálium; resembling the tooth-shell or *dentalium.*
dentálus, a, um; toothed; notched.
denticulátus, a, um; denticulated; small-toothed.
dêntifer, a, um; toothed; furnished with teeth-like processes.
deplêxus, a, um; wound round; folded round.
deprêssus, a, um; depressed; slightly hollow.
desmophy̆llus, a, um; bundle-leafed; in leaf-like clusters.
destrúctor; a destroyer; feeding on others.
Devóniênsis, is, e; of or belonging to Devonshire.
dichótomus, a, um; dividing into two; branching into two; forked.
dicranócerus, a, um; having two-forked horns.
dictyota; set with netting.
dídymus, a, um; double; twinned.
diffórmis, is, e; shapeless; ill-formed.
digitalifórmis, is, e; finger-like; fingered.
digitálus, a, um; finger-like, as the leaves of the horse-chestnut.
dígona; two-cornered.
dilatátus, a, um; dilated; widened; spread out.

dimidiátus, a, um ; halved ; divided in two.
discoídeus, a, um ; quoit-shaped ; disc-like.
discrétus, a, um ; divided.
díscus ; a quoit ; in the form of a quoit.
díspar ; unlike ; unequal.
disséctus, a, um ; dissected ; cut asunder.
dístans ; distant ; standing apart.
dístichus, a, um ; in two rows ; double-rowed.
distórtus, a, um ; distorted ; irregular in shape.
divaricátus, a, um ; straggling ; wide apart.
Díxoni ; after Dixon, the author of *Fossils of Sussex.*
dŏlābra ; an axe ; in the form of an axe.
dolabriformis, is, e ; axe-shaped.
doliáris, is, e ; tun-shaped ; barrel-like.
dolichodeirus ; long-necked.
dolium, a cask ; *doliolus,* a little cask.
donax ; a reed.
dorsalis, is, e ; belonging to back ; dorsal ; having a dorsal-ridge.
dorsátus, a, um ; high-backed.
draconocéphala ; dragon's head.
dúbius, a, um ; doubtful ; uncertain.
dumetósus, a, um ; bushy ; tufty.
duplicátus, a, um ; doubled ; folded in two.
duriúsculus, a, um ; rather hard ; hardish.

E

ebúrneus, a, um ; ivory-like ; having the texture of ivory.
echinátus, a, um ; spiny ; covered with spines like the hedgehog.
echinóphorus, a, um ; thorny ; bearing spines.
edéntulus, a, um ; toothless.
éditus, a, um ; lofty.
edulínus, a, um ; edible ; capable of being eaten.
édŭlis, is, e ; edible ; used as food.
effóssus, a, um ; dug out.
Egertoni ; after Sir Philip Egerton, fossil ichthyologist.
Eggénsis, is, e ; from the Isle of Egg, Hebrides.
Ehrenbérgii ; after Ehrenberg, the great German microscopist.
Eifelensis, is, e ; from Eifel in Germany—Lower Rhine.
elăphus ; the stag or red-deer ; stag-like.
elĕgans ; elegant ; handsome in form.
elephantoïdes ; elephant-like.
Elginénsis, is, e ; found at or belonging to Elgin in Morayshire.
ellípticus, a, um ; in the form of an ellipse (oval).
elongátus, a, um ; lengthened ; drawn out.
emarginátus, a, um ; emarginate ; having a notch at the end, as if a piece had been taken out.
empléura ; full-sided.

enórmis, is, e ; enormous ; unusually large.
ênsifer, a, um ; sword-bearing ; having pointed processes.
ênsis ; a sword ; tapering like a sword.
eocœnus, a, um ; found in the eocene or lower tertiaries.
ephíppium ; a saddle ; like a saddle.
equisetifórmis, is, e ; mare's-tail-shaped ; like the marsh plant equisetum.
erináceus, a, um ; hedgehog-like ; resembling the hedgehog.
ermineus, a, um ; like the ermine or weasel.
erósus, a, um ; gnawed ; bitten away.
erugátus, a, um ; not wrinkled ; smooth from marks having been worn away.
êscharoïdes ; like a chafing-dish ; grate-shaped.
esocínus, a, um ; pike-like ; relating to the pike-fish.
euglýphus, a, um ; well-carved ; distinctly marked.
êuŏdus ; well-toothed.
euómphalus, a, um ; well centred or bossed.
eupterygius, a, um ; well-finned or winged.
eurygnáthus ; wide-jawed ; broad-jawed.
evúlsus, a, um ; torn out.
exaltátus, a, um ; raised ; prominently elevated.
exarátus, a, um ; defaced as to marks previously existing ; worn off.
excavátus, a, um ; hollowed out ; scooped out.
excélsus, a, um ; lofty ; high in stature.
excísus, a, um ; cut off ; cut out ; erased.
exêrtus, a, um ; projecting.
exêsus, a, um ; corroded ; worn in holes.
exolêtus, a, um ; worn out ; defaced.
expánsilābrum ; broad-lipped ; spreading out at the lip.
expánsus, a, um ; widely spread ; spread out.
explanátus, a, um ; spread out ; clearly seen.
exscúlptus, a, um ; deeply sculptured ; sculptured out.
extenuátus, a, um ; thinned away ; drawn out into a thin edge.
exútus, a, um ; stripped off ; removed.

F

făba ; a bean ; like a bean.
fabagêlla ; little bean ; like a little bean.
falcátus, a, um ; falcate or sickle-shaped.
fálcifer, a, um ; sickle-bearing ; armed with sickle-like processes.
fallax ; fallacious ; deceptive.
fasciárius, a, um ; bandage-like ; band-shaped.
fasciátus, a, um ; bandaged ; striped.
fasciculátus, a, um ; faggot-like ; in bundles.
fascículus ; a faggot or bundle ; in tufts.
fastigiátus, a, um ; pointed ; peaked like a roof.
favosoïdes ; honeycomb-like.
favósus, a, um ; arranged like a honeycomb ; honeycombed.
fenestrátus, a, um ; window-paned ; reticulated.

férox ; fierce ; fitted for fierce work ; sharp-pointed.
fértĭlis, is, e ; fertile ; bearing seed.
fibrósus, a, um ; fibrous ; full of fibres.
fibulátus, a, um ; broach-like.
ficoïdes ; fig-like.
ficúlneus, a, um ; belonging to the fig-tree.
fidícula ; a little fiddle or kit.
filicifórmis, is, e ; fern-shaped ; fern-like.
filifórmis, is, e ; filiform ; thread-like.
filipenáris, is, e ; thread-finned or winged ; having thread-like fins.
filogránus, a, um ; thread-grained ; fine-grained.
filósus, a, um ; thread-like ; thready.
fimbriátus, a, um ; fringed.
fissicostátus, a, um ; having divided ribs ; cleft-ribbed.
fissúra ; a cleft ; having a cleft.
fissurélla ; a little cleft.
fistula ; a pipe or tube.
fistulósus, a, um ; pipe-like ; composed of small tubes.
Fittoni ; after Dr Fitton, the geologist.
flabellátus, a, um ; spread out like a fan.
flabellifórmis, is, e ; fan-shaped ; flabelliform.
flabéllulus ; a little fan.
flabéllum ; a fan ; fan-like.
flagelliformis, is, e ; whip-shaped ; thong-like.
Flemíngii ; after Professor Fleming of Edinburgh, naturalist.
flexi-costátus, a, um ; bent-ribbed.
flexuósus, a, um ; bent ; crooked.
floccósus, a, um ; wool-like ; fleecy.
floreális, is, e ; flowery ; flower-like.
flóriceps ; flower-headed ; like a head of flowers.
florigémma ; flowery-gemmed.
fluctuátus, a, um ; waving ; wavy.
fódiens ; digging ; burrowing in the earth.
foliáceus, a, um ; leaf-like ; leafy.
foliósus, a, um ; leafy ; abounding in leaves.
fólium ; a leaf or thin plate.
fontícola ; fountain-dwelling ; living in springs.
fontinális, is, e ; of or belonging to fresh-water springs.
foraminósus, a, um ; full of small holes.
formicátus, a, um ; ant-like.
formósus, a, um ; fair, beautiful.
fornicátus, a, um ; arched.
fossilis, is, e ; fossil or extinct, in contradistinction to recent or living.
foveolátus, a, um ; pitted ; covered with pit-like markings.
frondósus, a, um ; branching ; branchy.
frontális, is, e ; having a large front or forehead.
funális, is, e ; rope-like ; rope-shaped.
fungifórmis, is, e ; fungus-shaped ; mushroom-like.
fungoïdes ; fungus-like.
funiculátus, a, um ; cord-like ; corded.

furcátus, a, um; forked; branching in two.
furcillátus, a, um; marked with slightly bifurcating lines.
fuscátus, a, um; dark; tawny.
fusifórmis, is, e; spindle-shaped; tapering at both ends.

G

gagateus, a, um; agate-like; formed of agate.
gálĕus; a helmet; helmet-like.
galioïdes; like the plant *galium,* or "ladies' bed-straw."
Gaultínus, a, um; belonging to, or peculiar to, the Gault.
geminans; doubling; twin-form.
geminátus, a, um; doubled; in twins.
gemmátus, a, um; studded with gems; beaded.
geométricus, a, um; arranged in geometrical order.
gibbérrulus, a, um; somewhat humped; convex, or gibbous.
gibbósus, a, um; gibbous; humped; tumid.
gíbbus, a, um; humped; having a hump or sudden rise.
gigánteus, a, um; gigantic; unusually large.
gígas; a giant.
glăber, a, um; smooth.
glabrispínus, a, um; smooth-spined.
glándifer, a, um; acorn-bearing; gland-bearing.
globósus, a, um; globular; globose.
globuláris, is, e; globular; globe-shaped.
glomerátus, a, um; gathered in a mass; wound up like a clue.
glyphúrus, a, um; carved tail; sculptured tail.
Goldfussi; after Goldfuss, the celebrated naturalist.
gongyloïdes; knob-like.
goniodáctylus, a, um; corner-fingered.
grácilis, is, e; slender; slight in form.
gradátus, a, um; step by step; graduated.
grandi-spínus, a, um; great-spined; having large spines.
grandis, is, e; great.
Grantoni; from Granton quarry, near Edinburgh.
granulátus, a, um; granulated; having the surface dotted with small grains.
granulósus, a, um; covered with small granules; granular.
gráphicus, a, um; written on; inscribed with lines like writing.
Gráyii; after Dr Gray of the British Museum.
Greenockii; after the Earl of Greenock, mineralogist.
Greenoughii; after Mr Greenough, English geologist.
gregárius, a, um; gregarious; occurring in flocks, or masses.
Griestoniensis, is, e; from Grieston quarry (silurian) in Peeblesshire.
Griffithii; after Sir Richard Griffith, the Irish geologist.
grossicónus, a, um; thick-coned.
grumósus, a, um; grumous; in the form of small clusters of grapes.
gryphæoïdes; gryphæa or gryphite-like; like the beaked shell gryphæa.
guttátus, a, um; studded with guttæ, or small drops.
gyrósus, a, um; circular; twisted-like; greatly twisted.

H

haliotoïdes; shaped like the haliotis or ear-shell.
halócyon; sea-dog; sea-dog-like.
hamátus, a, um; hooked; hooked-like.
Hantoniensis, is, e; belonging to or found in Hampshire (Hants).
harpŭla; a little harp.
hastális, is, e; spear-like; spear-shaped.
hastátus, a, um; formed like a dart or spear.
hastifórmis, is, e; dart-shaped.
Hastíngsiæ; after the Marchioness of Hastings, collector.
haustéllum; a little bucket; bucket-like.
hebetátus, a, um; blunt.
Hebrídicus, a, um; of or belonging to the Hebrides.
helianthella; like a little sun-flower—said of certain corals.
helianthoïdes; sun-flower-like; rayed like the sun-flower.
helicínus, a, um; whorled like the snail-shell (*helix*).
helicoïdes; snail-shell-like.
helícteres; ear-rings; ear-drops.
helecteroïdes; ear-ring-like; ear-drop-like.
helvelloïdes; cabbage-like; shaped like a head of cabbage.
hemicidaroïdes; hemicidaris-like (a fossil sea-urchin).
hemisphéricus, a, um; hemispherical in form.
hemistóma; half-mouthed.
Henslóvii; after Professor Henslow of Cambridge, botanist.
heterodon; irregular-toothed.
heterogéneus, a, um; irregular in composition or parts.
heteromórphus, a, um; irregular in form.
heterophýllus, a, um; irregular-leaved.
heterúrus, a, um; irregular-tailed.
hexágonus, a, um; six-cornered or six-sided.
hians; gaping.
Hibbértii; after Dr Hibbert of Edinburgh, geologist.
Hibérnicus, a, um; found in, or belonging to Ireland, Irish.
hieroglýphicus, a, um; marked as if with hieroglyphics.
hippocástanum; horse-chestnut.
hippócrepis; horse-shoe.
hippopódium; horse-hoof; like the horse-hoof.
híppŏpus; horse-hoof (in the form of).
hirúdo; a leach; leach-like.
hispídulus, a, um; somewhat rough or bristly.
híspidus, a, um; rough; covered with long rigid hairs.
hiúlcus, a, um; gaping.
humerósus, a, um; broad-shouldered; humped.
Huttoni; after Dr Hutton, the celebrated geologist.
hyalaéus, a, um; glassy; having the lustre of glass.
hýbridus, a, um; hybrid; intermediate between two species.

hymenophyllöïdes ; membranous, leaf-like.
hypocrateriförmis, is, e ; salver-shaped.
hypnoïdes ; hypnum-like ; like the common moss hypnum.
hystrix ; a porcupine (covered with spines).

I

Ibbetsoni ; after Captain Ibbetson, geologist.
icosidáctylus, a, um ; twenty-fingered.
imbricatárius, a, um ; covered with tiles ; tile-like.
imbricátus, a, um ; imbricated ; overlapping like tiles.
impar ; unequal ; having unequal parts.
impréssus, a, um ; impressed ; stamped.
inæquális, is, e ; unequal ; not having equal parts.
inæquicostátus, a, um ; unequally ribbed.
inánis, is, e ; void ; empty.
incísus, a, um ; incised ; cut in ; slashed.
incónstans ; inconstant ; not always of one size or form.
incrassátus, a, um ; thickened.
incrústans ; incrusting other substances, as coral-growth, &c.
incúrvus, a, um ; incurved ; bent in.
inflátus, a, um ; inflated ; swollen, as if blown up.
infórmis, is, e ; shapeless ; without form.
infundibulifórmis, is, e ; funnel-shaped.
ingens ; huge ; unusually large.
intercellulósus, a, um; intercellular ; cell within cell.
intermédius, a, um ; intermediate (in size or form).
interstínctus, a, um ; divided.
intertextus, a, um ; interwoven ; ramifying.
intórtus, a, um ; twisted inwards.
intuméscens ; swelling up.
irrádians ; not radiating from a common centre.
irreguláris, is, e ; irregular ; not disposed in regular order.
isocárdia ; equal heart (regularly heart-shaped).
isogonoïdes ; equiangular-like.

J

jaculum ; a dart ; dart-shaped.
Jamesii ; after Colonel James of the Government Survey.
Jamesoni ; after Professor Jameson of Edinburgh, geologist.
Jardinii ; after Sir William Jardine, naturalist.
jubátus, a, um ; maned ; having a mane-like fringe.
jugális, is, e ; yoked together ; conjoined.
jugósus, a, um ; yoked together ; closely conjoined.
Jukesii ; after Mr Jukes of the Geological Survey of Ireland.
júnceus, a, um ; rush-stem-like.
juniperínus, a, um ; juniper-like ; like the juniper berry.

K

Keuperínus, a, um ; belonging to the Keuper, or Upper Trias.
Königii ; after König, the Belgian palæontologist.

L

labiátus, a, um ; labiate ; having lips.
labyrínthicus, a, um ; labyrinthine ; full of intricate windings.
lácerus, a, um ; torn ; ragged.
laciniátus, a, um ; slashed.
lácteus, a, um ; milky ; white as milk.
lacunósus, a, um ; having deep depressions.
læviceps ; smooth-head.
lævigátus, a, um ; smoothened ; polished.
lævis, is, e ; smooth ; polished.
lævissimus, a, um ; very smooth ; exceedingly smooth.
læviúsculus, a, um ; slightly smooth.
Lamárckii ; after Lamarck, French naturalist.
lamellósus, a, um ; in very thin plates.
laminátus, a, um ; laminated ; in thin plates.
lanceolátus, a, um ; lanceolate ; spear-shaped.
Landsburgii ; after the Rev. Dr Landsborough, algæologist.
latecáuda ; broad-tailed.
lateseptátus, a, um ; widely divided ; having septa or partitions wide apart.
laticostátus, a, um ; broad-ribbed.
látidens ; broad-toothed.
latifólius, a, um ; broad-leaved.
látifrons ; broad front ; broad-fronted.
latímanus, a, um ; broad-handed ; broad-finned.
latipénnis, is, e ; broad-finned or winged.
latissimus, a, um ; broadest ; very broad.
latiúsculus, a, um ; broadish ; somewhat broad.
latus, a, um ; broad.
lautus, or *lavátus, a, um ;* washed.
laxus, a, um ; loose ; loosely arranged.
leiodus ; smooth-tooth.
leiopleúrus ; smooth-ribbed.
leiosómus ; smooth-bodied.
lemniscátus, a, um ; labelled.
lenticuláris, is, e ; lenticular ; lens-shaped.
lenticulátus, a, um ; lens-shaped, having a double-convex surface.
lenticulínus, a, um ; lentil-like.
lentifórmis, is, e ; lens-shaped.
léntus, a, um ; slow.
lepidótus, a, um ; leprous ; covered with small peltate scales.

leporínus, a, um ; resembling the hare ; hare-like.
leptocéphalus, a, um ; slender-headed.
léptodus ; slender-tooth, slender-toothed.
leptógnáthus ; slender-jawed.
leptópterus, a, um ; slender-finned.
leptorhínus, a, um ; slender-nosed ; slender-snouted.
leptosóma ; slight-bodied ; slender-bodied.
leptósteus, a, um ; slender-boned.
Liássicus, a, um ; of or belonging to the Lias formation.
lichenoïdes ; lichen-like.
lignárius, a, um ; wood-like ; of wood.
ligulátus, a, um ; ligulate ; strap-shaped.
lima ; a file (like a file).
limbátus, a, um ; bordered.
linctus, a, um ; licked ; smoothened as if by licking.
Lindleyi, Lindleyanus, a, um ; after Dr Lindley, the eminent botanist.
lineátus, a, um ; marked with lines, striated.
lineolátus, a, um ; marked with little lines.
lingua ; the tongue ; tongue-like.
lingua-bóvis ; ox-tongue ; shaped like an ox's tongue.
linguifórmis, is, e ; tongue-shaped.
lingulátus, a, um ; in the form of a tongue.
Lísteri ; after Dr Lister, geologist.
litterátus, a, um ; lettered ; marked as if inscribed with letters.
lituifórmis, is, e ; trumpet-shaped.
lobátus, a, um ; lobate ; divided by a determinate number of segments.
lobifolius, a, um ; lob-leafed.
loculósus, a, um ; partitioned.
Logani ; after Sir William Logan, State Geologist for Canada.
lonchíodon ; long tooth, slender-toothed.
lonchítis ; the fern "adder's tongue ;" like the adder's tongue.
longibracteátus, a, um ; furnished with long bracts.
longiceps ; long-headed.
longicóllis, is, e ; long-necked.
lóngidens ; long tooth ; long-toothed.
longifólius, a, um ; long-leafed ; having long leaves.
longimanus ; long-handed.
longiróstris, is, e ; long-beaked ; long-snouted.
longissimus, a, um ; the longest ; of unusual length.
longitudinális, is, e ; lying lengthwise ; long and narrow.
lophíodon ; crested-tooth.
loricátus, a, um ; loricated ; resembling a coat of mail.
Ludénsis ; from or belonging to Ludlow, in Shropshire.
lunátus, a, um ; moon-shaped ; crescent-formed.
lunulátus, a, um ; lunulate ; half-moon-shaped.
lycopodoïdes ; lycopodium-like ; club-moss-like.
Lyéllii ; after Sir Charles Lyell, the geologist.
lyrátus, a, um ; lyrate ; lyre-shaped.

M

M'Coyanus, a, um ; after Mr M'Coy of Melbourne, geologist.
macilĕntus, a, um ; lank ; meagre ; scraggy.
macrocaúlis, is, e ; long-stemmed ; long-stalked.
macrochéirus, a, um ; long-handed ; having long pectoral fins.
macrodáctylus, a, um ; long-fingered.
macrodiscus, a, um ; long-disked ; having long leaf-scars.
mácrodus ; long tooth ; long-toothed.
macrolepidótus, a, um ; long-scaled ; large-scaled.
mácromus, a, um ; long shoulder-blade ; slender-shouldered.
macrónyx ; long claw ; long-clawed.
macrophthálmus, a, um ; long- or large-eyed.
macrophýllus, a, um ; long-leaved.
macropómum ; long cheek ; long-jawed.
macrópterus, a, um ; long-winged ; long-finned.
macropygópterus, a, um ; long tail-finned.
macrospondýlus, a, um ; long-backboned ; long-spined.
macrostómus, a, um ; long- or large-mouthed.
macrótus, a, um ; long- or large-eared.
macrúrus, a, um ; long-tailed.
mactroïdes ; like, or having the form of the shell *mactra.*
maculátus, a, um ; spotted ; mackled.
major, or, us ; the greater.
Malcolmsoni ; after Dr Malcolm of Elgin, Morayshire.
málleus ; a mallet, or hammer ; the shell *malleus.*
mammilláris, is, e ; mammillated ; pap-shaped.
mammillátus, a, um ; nipple-shaped ; mammillary.
mammílliferus, a, um ; pap-bearing ; covered with pap-like points.
mancus, a, um ; imperfect ; defective.
mandibuláris, is, e ; beaked ; bill-like ; mandibular ; furnished with mandibles.
mandibulátus, a, um ; bill-shaped ; furnished with a mandible.
Mantelli ; after Dr Mantell, the geologist.
margaritáceus, a, um ; pearly ; having the lustre of pearl.
margarítulus ; little pearl ; seed-pearl.
marginátus, a, um ; bordered ; having a distinct border.
marginélla ; little margin (a genus of shells).
Martini ; after Martin, the palæontologist of Derbyshire.
mastodónteus, a, um ; nipple-toothed ; teeth with tubercles.
maximus, a, um ; greatest ; the largest.
meandrínus, a, um ; meandering ; serpentine.
meandroïdes ; like the *meandrina* or brain-coral.
médius, a, um ; intermediate ; middling.
medulláris, is, e ; medullary ; having a pith.
megálodon ; large tooth ; large-toothed.
megalophýllus, a, um ; large-leaved.
megalótis, is, e ; great-eared ; great ear.

melacactoïdes; melocactus-like; resembling the melocactus.
melánia; black (a genus of shells).
melanoïdes; like the shell *melania;* black-like.
membranáceus, a, um; membrane-like; formed of membrane.
meniscoïdeus, a, um; meniscoid; concavo-convex.
mespilifórmis, is, e; medlar-shaped.
mícans; shining; glistening with enamel.
micástron; little star.
micracánthus, a, um; small-spined.
microcéphalus, a, um; small-headed.
mícrodus; small tooth; minute tooth.
microlepidótus, a, um; small-scaled.
microphýllus, a, um; small-leaved.
micropleúrus, a, um; small-sided.
micropórus, a, um; small-pored.
Milleri; after Mr Hugh Miller, geologist.
mínimus, a, um; the least; very small.
mínor, or, us; the less, less.
minútulus, a, um; very minute; minutely small.
minútus, a, um; minute, small.
miocœnus, a, um; found in the miocene or middle tertiaries.
mirábilis, is, e; wonderful; admirable.
mitræfórmis, is, e; mitre-shaped; mitriform.
mitrátus, a, um; mitre-like; in the form of a mitre.
modíola, modíolus; a bushel-measure (a genus of shells).
modioláris, is, e; bushel-shaped.
molendináceus, a, um; mill-sail shaped.
Monénsis, is, e; belonging to the Isle of Man (Mona).
moníle; a necklace; bead-string-like.
monilefórmis, a, um; necklace-shaped; bead-like.
moniletéctus, a, um; necklace-covered.
monilíferus, á, um; beaded; necklace-like.
monóceros; one-horned; the narwhal.
monticulátus, a, um; having many small projections; covered with conical points.
Morrísii; after Professor Morris of London, geologist.
mosáicus, a, um; tessellated like mosaic work; patterned.
mucronátus, a, um; sharp-pointed; dagger-like.
multicarinátus, a, um; having many keels or ridges.
múlticeps; many-headed.
multidigitátus, a, um; many-fingered.
multifidus, a, um; many-cleft; having many segments.
multigránulátus, a, um; many-grained; dotted with numerous grains.
multínervátus, a, um; many-nerved.
multinódus; many-knotted.
multiradiátus, a, um; many-rayed.
multisulcátus, a, um; many-furrowed.
Munsteriánus, a, um; after Count Munster, geologist.
Murchisóni; after Sir Roderick Murchison, the geologist.

muricátus, a, um ; like the shell *murex.*
Murrayánus, a, um ; after Dr Murray of Yorkshire.
muscarifórmis, is, e ; brush-shaped.
músculus ; a little mouse; mouse-like.
mutábilis, is, e ; mutable; changeable.
múticus, a, um ; without a beard; beardless.
mýa ; gaper (a genus of shells).
mysticétus, a, um ; sperm-whale-like.
mytiloïdes ; like the *mytilus,* or mussel-shell.

N

nánus, a, um ; dwarfish.
napifórmis, is, e ; turnip-shaped.
nasútus, a, um ; having a prominent nose.
nautiloïdea ; resembling the shell *nautilus.*
nautilus ; a little sailor (a genus of chambered shells).
navícula ; a little ship; boat-shaped.
naviculáris, is, e ; ship-like.
návis ; a ship.
neglćctus, a, um ; neglected; overlooked.
nemorális, is, e ; frequenting woods; of the grove.
Neocomiensis, is, e ; of or belonging to the *Neocomian* or Lower Greensand formation.
nephrocárpus, a, um ; kidney-fruited; fruit kidney-shaped.
nervósus, a, um ; full of nerves.
nexílis, is, e ; entwined; interlaced.
Nicoli ; after Professor Nicol of Aberdeen, geologist.
nitens ; bright; shining.
nitídulus, a, um ; rather neat.
nítidus, a, um ; neat; pretty.
níveus, a, um ; snowy; white as snow.
nóctulus, a, um ; belonging to the twilight; of twilight habits.
nodósus, a, um ; knotty; knobbed.
nodulósus, a, um ; in small knots.
Nöggeráthii ; after Dr Nöggerath, German fossil botanist.
normális, is, e ; normal; according to rule; following the usual structure.
Norvegicus, a, um ; of or belonging to Norway.
notátus, a, um ; marked; stamped with a mark.
núcleus ; a kernel; kernel-like.
núcula ; a little nut (a genus of bivalve shells).
núdus, a, um ; naked; uncovered.
numismális, is, e ; coin-like (round-lenticular).
nummárius, a, um ; coin-like; coin-shaped.
nummifórmis, is, e ; coin-shaped; in the form of small coins.
nummulárius, a, um ; nummulus-like in form.
númmulus, or little coin (a genus of foraminiferous shells, so called from their form).
nútans ; nodding; bent downwards.

O

obcónicus, a, um ; rather conical ; slightly conical.
obésus, a, um ; fat ; plump in form.
oblátus, a, um ; oblate ; broader than long ; broadly-round.
obliquátus, a, um ; oblique ; slanting.
oblíquus, a, um ; oblique ; leaning to one side.
oblongus, a, um ; oblong ; rather long ; longer than broad.
obovátus, a, um ; egg-shaped ; with the broad end uppermost.
obsolétus, a, um ; obsolete ; scarcely distinguishable at the margin.
obtusilóbus, a, um ; obtuse-lobed ; having blunt lobes.
obvolútus, a, um ; folded ; tied about.
ocellátus, a, um ; furnished with little eyes, or eye-specks.
ochráceus, a, um ; ochrey ; having the colour of ochre.
octoplicátus a, um ; eight-folded.
oculátus, a, um ; full of eyes, or eye-like dots.
oculínus, a, um ; eye-like ; spotted with eyes.
Oldhami ; after Professor Oldham of Dublin.
oliváceus, a, um ; olive-like ; olive-coloured.
ólla ; a pot ; pot-shaped.
onýchius, a, um ; shaped like a little claw.
oocéphalus, a, um ; egg-headed ; broad end up.
opalínus, a, um ; opal-like ; having the lustre of opal.
operculáris, is, e ; furnished with an opercular bone ; opercular.
oppósitus, a, um ; opposite ; placed on opposite sides.
orbícula ; rounded ; little orb (a genus of shells).
orbiculáris, is, e ; orbicular ; orb-shaped.
órganum ; an organ ; arranged like the pipes of an organ.
ornatissimus, a, um ; most ornamented ; highly ornamented.
ornátus, a, um ; ornamented ; adorned.
ornithocéphalus, a, um ; bird-headed ; like a bird's head.
oryza ; a grain of rice ; like a rice-grain.
ósculifer, a, um ; having a little mouth.
ósseus, a, um ; bony ; composed of, or armed with bone.
ostreæfórmis, is, e ; oyster-shaped.
ovális, is, e ; oval ; in the form of an egg.
ovátus, a, um ; ovate ; egg-shaped.
ovifórmis, is, e ; egg-shaped ; ovate.
ovoïdea ; egg-like ; in the form of an egg.
óvula ; a little egg (a genus of shells).
O'weni ; after Professor Owen, the celebrated naturalist.

P

pachydérma ; thick-skinned ; thick-barked.
pachygnáthus ; thick-jawed ; strong-jawed.

pachýomus ; thick-shoulder-blade ; thick-shouldered.
pachyópterus, a, um ; thick-finned ; thick-winged.
paleátus, a, um ; chaffy.
pállidus, a, um ; pale-coloured.
palmátus, a, um ; palmate ; having five lobes like the fingers of the human hand.
palpebrósus, a, um ; having large eyelids ; deeply fringed.
pandurátus, a, um ; fiddle-shaped.
pándus, a, um ; bent downwards.
paníceus, a, um ; bread-like ; in the form of a cake of bread.
papaveráceus, a, um ; poppy-like.
papilionátus, a, um ; butterfly-shaped.
papillátus, a, um ; nipple-like ; covered with papilli.
papillósus, a, um ; covered with numerous tubercles.
paradóxus, a, um ; questionable ; extraordinary.
paradóxicus, a, um ; paradoxical ; puzzling ; questionable.
parasíticus, a, um ; parasitic ; living on or attached to another.
pardoïdes ; panther-like ; allied to the panther.
Parisiensis, is, e ; belonging to Paris ; found near Paris.
Parkinsonis, is, e ; after Parkinson the palæontologist.
párvidens ; small-toothed.
párvulus, a, um ; very small ; diminutive.
parvus, a, um ; small.
patélla ; a small plate ; the knee-pan ; the limpet-shell.
patelláris, is, e ; limpet-shaped.
patélliformis, is, e ; patella or limpet-shaped.
patens ; spreading ; exposed.
patulósus, a, um ; broad ; expanding.
pátulus, a, um ; broad ; spread out.
páucidens ; few-toothed ; having few teeth.
paucifólius, a, um ; few-leafed ; having few leaves.
paucisulcátus, a, um ; having few furrows or depressions.
pauperátus, a, um ; impoverished ; meagre.
paxillósus, a, um ; resembling a little stake.
Peachii ; after Mr Charles Peach, collector and discoverer.
pecten ; a comb (the scallop-shell) ; comb-like.
pectinátus, a, um ; pectinated ; toothed like a comb.
pectínifer, a, um ; comb-bearing.
pectinoïdes ; comb-like.
pectúnculus ; little comb (a genus of shells).
pedéstris, is, e ; furnished with feet ; footed.
pédum ; a shepherd's crook.
pedunculátus, a, um ; furnished with a footstalk or peduncle.
pelágicus, a, um ; belonging to the deep sea.
péllis serpéntis ; serpent's skin.
pellúcidus, a, um ; quite transparent ; pellucid.
peltátus, a, um ; buckler- or half-moon shaped.
peltiformis, is, e ; in the form of a half-moon buckler.
pencíllus ; a brush or pencil.

Pengéllyi; after M. Pengelly of Torquay, geologist.
pennæfórmis, is, e; feather-like; feather-shaped.
pennicóstis, is, e; feather-ribbed.
pentágonus, a, um; five-cornered; pentagonal.
pentrematoïdes; like or resembling the pentremite.
perámplus, a, um; very large; unusually large.
perarmátus, a, um; completely armed.
peregrínus, a, um; foreign; wandering.
perforátus, a, um; perforated; full of holes or pores.
perlátus, a, um; very broad; very wide; unusually wide.
Permiánus, a, um; of or belonging to the Permian System.
perornátus, a, um; highly ornamented; unusually ornamented.
perovális, is, e; very oval; almost round.
per-reticulátus, a, um; highly reticulated; reticulated all over.
personátus, a, um; personate; mask-like.
pertúsus, a, um; pierced; struck through.
pes-ánseris; goose-foot; shaped like a goose's foot.
pes-ránæ; frog-foot; shaped like the frog's foot.
petalíferus, a, um; bearing petal-like appendages.
petallifórmis, is, e; shaped like the petals of a flower.
petiolátus, a, um; furnished with a petiole or leaf-stalk.
petrícolus, a, um; stone-dwelling; living in stone.
phaseolínus, a, um; kidney-bean-shaped.
Phillipsii; after Professor Phillips of Oxford, geologist.
phrágmiger, a, um; separated by thin partitions; partitioned.
píctus, a, um; painted.
pileáris, is, e; in the form of a peaked hat or cap.
piléopsis; like a peaked hat (a genus of limpet-like shells).
pilíferus, a, um; hair-bearing; hair-pointed.
píllula; a little ball or pill.
pinàster; like the pine-tree, *pinaster.*
pinifórmis, is, e; pine-shaped; pine-tree-like.
pinna; a fin; the bivalve shell *pinna.*
pirifórmis, is, e; pear-shaped, pyriform.
piscatórius, a, um; fishing; fish-catching.
pisifórmis, is, e; pea-shaped.
pistillifórmis, is, e; pestle-shaped; in form of a pestle.
placentifórmis, is, e; placenta or cake-shaped.
planátus, a, um; smoothed; plain.
plániceps; smooth-headed; flat-headed.
planicostátus, a, um; smooth-ribbed.
planórbis; even-whorled; having the spires lying in the same plane (a genus of spiral-circular shells).
planulátus, a, um; rather smooth; somewhat flat.
platycéphalus, a, um; broad-headed.
platynótus; broad back.
platýodon; broad-toothed.
platýpterus, a, um; broad-finned.
plátypus, a, um; broad-footed.

platyrachis; having a broad rachis or stalk.
pleíodon; pleiodus; the larger-toothed.
plica; a fold or plait.
plicatélla; a little fold or plait.
plicátilis, is, e; slightly folded, in small folds.
plicátus, a, um; folded, plaited.
plicómphalus, a, um; folded in the middle or navel.
pliocœnus, a, um; found in the pliocene or upper tertiaries.
plúma; a feather or plume.
plumárius, a, um; plume-like; feathery.
plumósus, a, um; feathery.
pluriradiális, is, e; many-rayed, as in certain corals.
poculifórmis, is, e; cup- or goblet-shaped.
podocarpoïdes; like the *podocarpus,* one of the yews.
polítus, a, um; polished; smoothed; not figured.
Pollexfeni; after the Rev. Mr Pollexfen, naturalist.
polydáctylus, a, um; many-fingered.
polygonátus, a, um; many-angled; many-cornered.
polýgyrus, a, um; many-twisted; many-circled.
polymórphus, a, um; many-shaped; of many forms.
polýodus, a, um; many-toothed.
polyómmata; many-eyed.
polyphýllus, a, um; many-leaved.
polýpodioïdes; like the fern *polypodium* or polypody.
polyspondylus, a, um; having many vertebræ.
polystáchya; many-spiked; many-eared.
polýtoma; cut into many parts.
ponderósus, a, um; heavy; bulky.
porósus, a, um; full of pores; porous.
porréctus, a, um; stretched out.
Portlockii; after Major-General Portlock, geologist.
præacútus, a, um; very acute; thin and sharp.
præmórsus, a, um; jagged as if bitten off.
praténsis, is, e; inhabiting meadow- or river-land.
Prestvici; after Mr Prestwich of London, geologist.
Prevostii; after M. Constant Prevost, French geologist.
primævus, a, um; primeval; very ancient.
primigénius, a, um; original; first-born.
primordiális, is, e; primordial; first in order.
príscus, a, um; ancient.
pristodóntus, a, um; saw-toothed; jagged like a saw.
Pritchardi; after Mr Pritchard, the microscopist.
problemáticus, a, um; problematical; doubtful.
proboscoïdeus, a, um; proboscis-like.
prolíferus, a, um; putting forth a new shoot.
propínquus, a, um; neighbouring; related to.
propterýgius, a, um; fore-finned.
prostrátus, a, um; prostrate; creeping on the ground.
proténsus, a, um; stretched forth; stretched out.

pruniförmis, is, e ; prune-shaped.
psilopóra ; having smooth pores ; smooth-pored.
psittacínus, a, um ; parrot-like ; bent like a parrot's bill.
pteroïdes ; wing-like ; fern-like.
ptychoïdes ; wrinkle-like.
pubéscens ; downy ; covered with fine hairs.
pucíllus, a, um ; very small.
pulchéllus, a, um ; lovely ; minutely pretty.
púlcher, a, um ; beautiful.
pulchérrimus, a, um ; fairest ; very beautiful.
pulvérulentus, a, um ; covered as with small dust ; powdery.
pulvinárium ; a cushion ; cushion-shaped.
pulvinátus, a, um ; cushioned.
púmĭlus ; a dwarf or pigmy.
punctátus, a, um ; punctured ; marked with dots ; dotted.
Purbeckensis, is, e ; from the isle of Purbeck in Dorsetshire.
pustulátus, a, um ; pustuled ; covered with pustules.
pustulósus, a, um ; full of, or all over with pustules.
pygmæus, a, um ; diminutive in size ; pigmy-like.
pyramidális, is, e ; pointed like a pyramid.
pyriförmis, is, e ; pyriform ; pear-shaped.

Q

quadranguláris, is, e ; quadrangular ; four-sided.
quadrátus, a, um ; square-shaped.
quadricostátus, a, um ; four-ribbed.
quadrifidus, a, um ; cleft or split into four.
quadrigéminus, a, um ; four times doubled.
quadriplicátus, a, um ; four-folded.
quadrisulcátus, a, um ; four-furrowed.
quadrivillátus, a, um ; having four chaplets.
quinquecostátus, a, um ; five-ribbed.

R

racemósus, a, um ; full of bunches, bunchy.
racémus ; a bunch or cluster of florets.
radiátus, a, um ; radiating from a point ; ray-like.
rádicans ; rooting ; branching out like roots.
radicifórmis, is, e ; root-shaped ; root-like.
radio-punctátus, a, um ; marked with radiating or star-like punctures.
ramósus, a, um ; branching ; having many branches.
Rankineí ; after Dr Rankine of Carluke, in Lanarkshire.
raphíodon ; needle-toothed ; prickle-tooth.
raricostátus, a, um ; having few rib-like processes.

rarispínus, a, um ; having few spines.
raristélla ; having few star-like pores.
rastéllum ; a little rake ; rake-like.
réctus, a, um ; straight ; without bend.
recurviróstra ; bent beak or jaw.
recúrvus, a, um ; bent back.
remifórmis, is, e ; oar-shaped.
renifórmis, is, e ; kidney-shaped.
repándus, a, um ; repand ; slightly waved at the margin.
replicátus, a, um ; folded back upon itself.
resupinátus, a, um ; upside down.
retiárius, a, um ; netted ; meshed like a net.
reticulátus, a, um ; reticulate ; like network.
retrórsus, a, um ; turned backwards ; bent back.
retrúsus, a, um ; thrust back ; hidden ; concealed.
retúsus, a, um ; blunt.
revolútus, a, um ; turned back ; curled back.
rhaphíodon ; club-tooth ; shaped like a club.
rhómbus ; a rhomb or lozenge ; lozenge-like.
rhomboïdes ; like a lozenge ; diamond-shaped.
Richardsoni ; after Mr Richardson of London, geologist.
rígidulus, a, um ; somewhat stiff ; stiffish.
rígidus, a, um ; rigid ; stiff ; not flexible.
rimósus, a, um ; full of chinks.
ríngens ; gaping ; having an open orifice.
Robertsoni ; after Mr Robertson of Edinburgh, geologist.
rostalínus, a, um ; having a little beak.
rostrátus, a, um ; beaked.
rostro-minor, or, us ; minor-beaked ; lesser-snouted.
rótátus, a, um ; wheel-shaped ; wheel-like.
Rothomagensis, is, e ; from or belonging to Rouen.
rótifer, a, um ; wheel-bearing.
rótulus, a, um ; slightly rounded.
rotundátus, a, um ; rotund ; rounded.
rúdis, is, e ; not worked or fashioned ; rude.
rugátus, a, um ; wrinkled.
rugósus, a, um ; full of wrinkles.
rugulósus, a, um ; somewhat wrinkled ; minutely wrinkled.
runcinátus, a, um ; hook-backed.

S

sagittátus, a, um ; arrow-shaped ; barbed like an arrow.
sagíttula ; a little arrow ; like a little arrow.
salmóneus, a, um ; salmon-like ; pertaining to the salmon.
sarcinulátus, a, um ; having a wallet or pouch.
sauroplésius, a, um ; most closely allied to the lizard family.
saxátilis, is, e ; stony.

scabrículus, a, um ; rough.
scabriúsculus, a, um ; somewhat rough ; roughish.
scaláriffórmis, is, e ; ladder-shaped.
scarabæus, a, um ; beetle-shaped ; beetle-like.
scaraboïdes ; beetle-like ; like the scarabæus.
scariósus, a, um ; scarious ; having a dry shrivelled appearance.
schizúrus, a, um ; split-tail ; rent-tail.
scobriculátus, a, um ; pitted.
scopifórmis, is, e ; tufted ; tuft-shaped.
Scotticus, a, um ; Scottish ; found in Scotland.
Scouleri ; after Dr Scouler of Glasgow, naturalist.
scrofa ; a sow ; sow-like.
scrotifórmis, is, e ; pouch-shaped.
scutátus, a, um ; shield-like ; buckler-shaped.
scutellifórmis, is, e ; buckler-formed.
scutifórmis, is, e ; scute- or shield-shaped.
sectus, a, um ; cut or cleft.
secundárius, a, um ; secondary ; second in order ; inferior.
securifórmis, is, e ; hatchet-shaped.
Sedgwíckii ; after Professor Sedgwick of Cambridge, geologist.
selaginoïdes ; selago-like ; leafed like the plant *selago*.
semiflabéllifórmis, is, e ; half fan-shaped.
semiglóbus ; half-globe ; hemispherical.
semiornátus, a, um ; half-ornamented.
semiplánus, a, um ; half-smooth.
semiplicátus, a, um ; half-folded.
semiserrátus, a, um ; half-serrated.
semistriátus, a, um ; half-striated.
semisulcátus, a, um ; half-furrowed.
semiteres ; half-taper.
semiverrucósus, a, um ; half-warty.
senticósus, a, um ; covered with prickles ; prickly.
septátus, a, um ; divided by septa or partitions.
septemplicátus, a, um ; seven-folded.
septósus, a, um ; full of septa or partitions.
seriális, is, e ; in rows or series.
seríceus, a, um ; silky.
serpentínus, a, um ; serpentine ; winding.
serpulárius, a, um ; serpula-like ; worm-like.
sérpulus, a, um ; creeping ; worm-formed.
serra ; a saw ; saw-like.
serratíssimus, a, um ; highly serrated ; excessively serrated.
serrátus, a, um ; saw-edged ; serrated.
serríferus, a, um ; bearing serrations.
serrulátus, a, um ; minutely serrated.
sértus, a, um ; bound ; joined together.
sigmoïdeus, a, um ; sigma-shaped ; like the letter S.
siliquária ; pod-like.
Sillimani ; after Professor Silliman, the American geologist.

Silúriensis, is, e; belonging to the Silurian System.
simillimus, a, um; most like; most closely allied to.
simplex; simple; undivided; not branching.
sinistrórsus, a, um; left-handed; turned to the left.
sinuátus, a, um; marked with depressions; wavy.
sociális, is, e; living in groups; social.
solenoïdes; like the razor-shell, *solen.*
Sowerbii; after Mr Sowerby of London, conchologist.
spatulátus, a, um; spatula-shaped; spatulate; blade-shaped.
speciósus, a, um; beautiful.
spectábilis, is, e; notable; worth seeing.
spelæus, a, um; belonging to a cave; cave-dwelling.
speluncárius, a, um; cavernous.
sphæroïdélis, is, e; spherical.
spictátus, a, um; spiked; in spikes like an ear of corn.
spíniger, a, um; spiny; bearing spines.
spínipes; spine-footed; having the feet armed with spines.
spinósus, a, um; spiny; covered with many spines.
spinulósus, a, um; full of little spines.
spirátus, a, um; having spires; spiral.
spirórbis; spiral-whorl (shell of an annelid).
squamátus, a, um; scaly; furnished with scales.
squámiger, a, um; carrying scales; faintly scaled.
squamósus, a, um; scaly; covered with scales.
stelláris, is, e; starred; rayed like a star.
stellátus, a, um; starred; covered with star-like dots.
Sternbérgii; after Count Sternberg, fossil botanist.
stramíneus, a, um; as if covered with straw.
striatéllus, a, um; minutely striated; slightly striated.
striáto-punctátus, a, um; spotted in striæ or parallel lines.
striátulus, a, um; somewhat striated.
striátus, a, um; striated; minutely fluted.
Stricklandii; after Mr Hugh Strickland, English geologist.
striolátus, a, um; very minutely striated.
stromboïdes; resembling the shell *strombus.*
Stutchburii; after Mr Stutchbury, geologist.
stylóphora; mark-bearing; impressed with a mark.
subangulátus, a, um; somewhat cornered.
subarátus, a, um; somewhat defaced (literally ploughed up).
subarcuátus, a, um; slightly bow-shaped or bent.
sub-armátus, a, um; somewhat armed.
subcarinátus, a, um; somewhat keeled; furnished with slight ridges; indistinctly ridged.
subconvéxus, a, um; somewhat convex.
sub-cristátus, a, um; rather crested.
subdepréssus, a, um; somewhat depressed.
subfusifórmis, is, e; somewhat spindle-shaped.
subnúdus, a, um; somewhat naked.
sub-reticulátus, a, um; somewhat reticulated.

subrotúndus, a, um; sub-rotund; somewhat round; roundish.
sub-serrátus, a, um; slightly serrated.
súbteres; somewhat tapering.
subtrígonus, a, um; somewhat three-cornered.
subturbinátus, a, um; somewhat top-shaped.
subulátus, a, um; awl-shaped; subulate.
subúlidens; awl-toothed; having awl-shaped teeth.
Suffolciénsis, is, e; of or belonging to Suffolk.
sulcátus, a, um; furrowed.
súlcifer, a, um; bearing furrows; marked with furrows.
sulcostómus, a, um; having a mouth deeply furrowed.
supérbus, a, um; superb; magnificent.
Sussexiénsis, is, e; found in or belonging to Sussex.
sylvéstris, is, e; belonging to the woods.

T

tabulátus, a, um; boarded; planked.
tæniánus, a, um; tapeworm-shaped.
tarándus; the rein-deer; rein-deer-like.
taxínus, a, um; belonging to the yew-tree; yew-like.
táxus; the badger; badger-like.
tenéllus, a, um; very tender; delicate.
Tennanti; after Professor Tennant of London, mineralogist.
tenuicáulis, is, e; slender-stemmed or stalked.
ténuiceps; slender head; slender-headed.
ténuidens; slender tooth; slender-toothed.
tenuifasciátus, a, um; slender-banded.
tenuifólius, a, um; slender-leaved.
tenuilamellósus, a, um; having slender lamellæ, or thin plates.
tenuiróstris, is, e; slender-beaked; slender-snouted.
tenuis, is, e; slight; slender.
tenui-séptus, a, um; slightly divided; slender partitioned.
tenuispínus, a, um; slender-spined.
tenuistriátus, a, um; finely striated; slightly striated.
térebra; a borer or auger.
terebrátus, a, um; bored; perforated.
tĕres; rubbed to a point; tapering.
teretiúsculus, a, um; slightly tapering; somewhat taper.
tessellátus, a, um; tessellated, like the squares of a dice-board.
testacélla, little shell.
testudinifórmis, is, e; turtle- or tortoise-shaped.
tetrágonus, a, um; four-cornered.
tetrásticha; in four rows.
téxtilis, is, e; woven; like a web.
thujoïdes; like the *thuja* or arbor-vitæ, one of the coniferæ.
thymifólius, a, um; thyme-leafed; leaves like the thyme.
thyreospóndylus; having perforated vertebræ.

tichorhinus, a, um; partition-wall-nosed; applied to a fossil rhinoceros in allusion to the structure of the nose- or snout-bones.
tintinnábulum; a little bell; like a little bell.
toliápicus, a, um; pestle-like; from the isle of Sheppey.
tomentósus, a, um; thickly covered with short stiff hairs.
torquátus, a, um; twisted round.
tortuósus, a, um; tortuous; twisted.
Trailli; after Dr Traill of Edinburgh, naturalist.
transversus, a, um; transverse; cross-wise.
trapezifórmis, is, e; four-sided; trapezium-like.
triacontadáctylus, a, um; thirty-fingered.
trichótomus, a, um; divided into three.
tridáctylites; three-fingered; three-fingered-like.
trífidus, a, um; cleft or divided into three.
trifoliátus, a, um; three-leafed.
trifurcátus, a, um; three-forked.
trigonéllaris, is, e; triangular; three-cornered.
trigóniceps; triangular-headed.
trigonocánthus, a, um; three-cornered spine.
trigonócerus, a, um; three-cornered or triangular horn.
trigonópsis; three-cornered-like.
trígonus, a, um; three-cornered.
trilobátus, a, um; three-lobed; in three main parts.
trinérvis, is, e; three-nerved; having three veins.
trochleáris, is, e; pulley-shaped.
trochoïdes; like the *trochus* or wheel-shell.
tropæus, a, um; twisted or turned round.
truncátus, a, um; truncated; cut short.
tubæfórmis, is, e; trumpet-shaped.
tuberculátus, a, um; covered with tubercles; warty.
tuberósus, a, um; tuberose; composed of tuber-like parts.
tubipóra; organ-piped; tubular-pored.
tubuláris, is, e; hollow like a pipe; tubular.
tubulátus, a, um; furnished with pipe-like pores or passages.
tubulósus, a, um; abounding in tubes; made up of tubes.
tumídulus, a, um; slightly swollen.
túmidus, a, um; tumid; swollen out.
Tunstallénsis, is, e; after Tunstall Hill in Durham.
turbinátus, a, um; top-shaped.
turbinéllus, a, um; little top-shaped.
turbinoïdes; shaped like a top.
túrgidus, a, um; turgid; swollen out.
turris; a tower; tower-shaped.

U

umbélla; an umbrella; umbrella-like.
umbilicátus, a, um; navel-shaped; umbilicated.

umbonátus, a, um; bossed; protuberant.
umbraculifórmis, is, e; umbrella-shaped.
umbrósus, a, um; shadowed.
uncátus, a, um; hooked; hook-shaped.
uncifólius, a, um; hook-leafed; hook-like leaf.
uncinátus, a, um; hooked; furnished with hooks.
úndans; waving; in waving lines.
undátus, a, um; wavy.
undulátus, a, um; undulating; in wavy lines.
unguifórmis, is, e; claw-shaped.
unicarinátus, a, um; having one ridge or keel.
unicólor; one-coloured; of uniform colour.
unilineátus, a, um; one-lined; marked with one line.
uniplicátus, a, um; once folded.
urceolátus, a, um; pitcher-shaped; pitcher-like.
Urii; after the Rev. Dr Ure of Rutherglen.
urophýllus, u, um; tail-leafed; tapering like a tail.
utriculáris, is, e; bag-like.

V

vágans; wandering.
vagína; a sheath.
Valdénsis, is, e; belonging to the Wealden formation.
validus, a, um; strong; stoutly built.
variábilis, is, e; variable; not always the same.
varians; variable; changing.
varicósus, a, um; varicose; having swollen veins.
variocostátus, a, um; differently ribbed; having ribs of different sizes.
varioláris, is, e; spotted with pimples.
vasculáris, is, e; vascular; having little vessels.
Vectiensis, is, e; of or belonging to the Isle of Wight.
velámen; a covering or veil.
vêlicans; sail-like; with sail-like fins.
velox; swift; fitted for rapid motion.
velutínus, a, um; velvety; soft.
venósus, a, um; full of veins.
ventricósus, a, um; bulging out; bellying.
ventroplánus, a, um; smooth-bellied.
venústus, a, um; fair; elegant.
vermiculáris, is, e; worm-shaped; vermicular.
vermiculoïdes; worm-like; vermicular.
Vernuiliánus, a, um; after M. Verneuil, geologist.
vertebrális, is, e; vertebra-like.
verticillátus, a, um; whorled; verticillate.
verrucósus, a, um; warty; covered with wart-like projections.
verus, a, um; true; genuine.
vesiculáris, is, e; vesicular; bladder-like.
vesiculósus, a, um; full of vesicles; bladdery.

vetústus, a, um ; ancient.
villósus, a, um ; villous ; covered with soft short hairs.
vimíneus, a, um ; osier-like ; withy.
violáceus, a, um ; approaching to a violet hue.
virgátus, a, um ; twig-shaped ; rod-like.
vírgula ; a rod or twig.
virgulátus, a, um ; rod-shaped ; like a bundle of rods.
vitreus, a, um ; glassy ; like glass in lustre.
vittátus, a, um ; banded or bound with a fillet.
vómer ; a plough-share ; plough-share-like.
vulgáris, is, e ; vulgar ; very common.
vulgátus, a, um ; common.

W

Waterhóusii ; after Mr Waterhouse of London, zoologist.
Whitbiénsis, is, e ; from Whitby on the Lias in Yorkshire.
Williamsonis ; after Dr Williamson of Scarborough, botanist.
Wíthami ; after Dr Witham of Edinburgh, palæontologist.
Woodii ; after Mr Searles Wood of London, geologist.
Woodwardii ; after Mr Woodward, conchologist.
Wrightii ; after Dr T. Wright of Manchester, palæontologist.

X

xíphodon ; sword-tooth ; having a sword-like tooth.

Z

zamioïdes ; zamia-like ; resembling the plant *zamia.*
zebra ; the zebra ; striped or banded like the zebra.
zic-zac, zig-zag ; slanting in straight lines from side to side.
zingiberifórmis, is, e ; ginger-root-shaped.

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